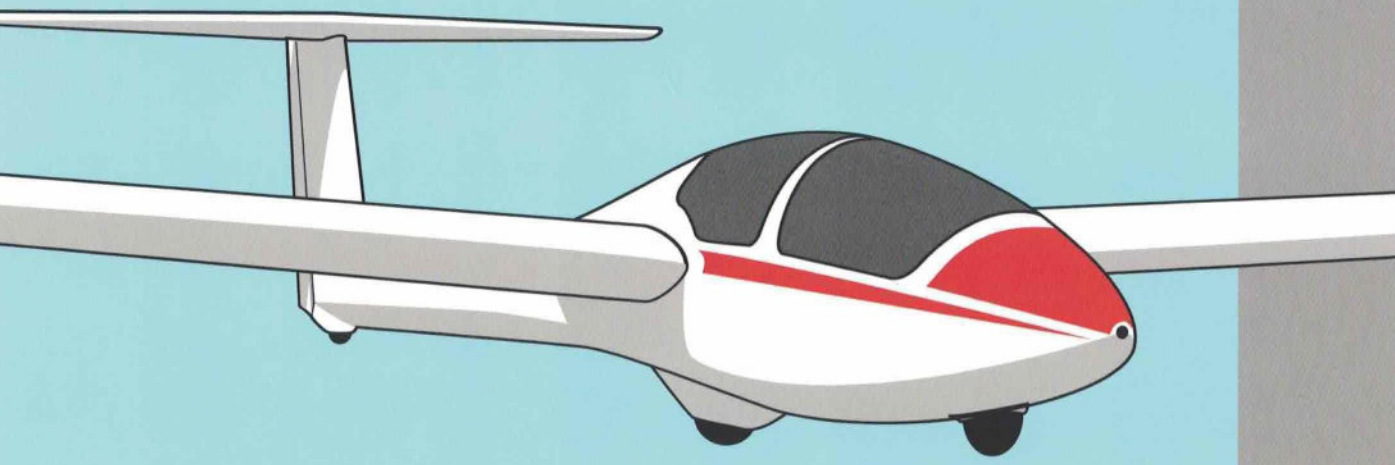
Flight Training Manual for Gliders

Russell Holtz



Student Name: _____

Phone #: _____

E-Mail: _____

Started Training: _____

Phase I Complete: _____

Student Certificate: _____

Pre-Solo Test: _____

Solo Statement

I certify that I have received training and am competent in all areas marked as "required before solo" on the reverse side of this card, and that I have no medical conditions that would prevent me from safely piloting a glider.

_____ _____

Student Signature Date

Phase II/First Solo: _____

Written Sign-Off: _____ Score: _____

Solo Flights: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Phase III/Pract. Sign-Off: _____

Certificate Issued: _____

"A" Badge

_____ Passed Pre-Solo Knowledge Test
_____ Completed Pre-Solo Flight Training
_____ Obtained a Student Pilot Certificate/Log Book
_____ Completed Solo Flight

"A" Badge Completed/Awarded: _____

"B" Badge

_____ Solo Flight of at least 30 minutes from a 2000' AGL tow (add 1.5 minutes for each 100' above 2000' AGL)

"B" Badge Completed/Awarded: _____

"C" Badge

Has Knowledge of:

_____ Cross Country Procedures
_____ Sailplane assembly, disassembly, and retrieving
_____ Dangers of Cross Country Soaring

Solo Flight Experience:

_____ Solo Practice (2 hours minimum)
_____ Solo flight of at least 60 minutes after a 2,000' AGL tow (add 1.5 minutes for each 100' above 2000'AGL)

While accompanied by an SSA Instructor:

_____ Performed a simulated off-field landing approach without reference to the altimeter
_____ Performed a "spot" landing, touching down and stopping wthin 500' of a designated point.
_____ Dual soaring practice, including instruction in techniques for soaring thermals, ridges, and wave (simulated or ground instruction may be used if suitable conditions do not exist)

"C" Badge Completed/Awarded: _____

Bronze Badge

_____ Recieved A, B, and C badges
_____ At least 15 solo glider hours, including at least 30 solo flights with at least 10 flights in a single place glider.
_____ At least 2 solo flights of at least 2 hours each.
_____ At least 3 solo spot landings in a glider witnessed by an SSAI.
_____ Logged dual time with a CFI-G during which 2 accuracy landings are made without reference to the altimeter.
_____ Passed a closed book written exam with a score of at least 80%.

Bronze Badge Completed/Awarded: _____

Previous Exp.: _____

Age: _____ Weight: _____

Flight Training Progress Record

Student Name:_____

		Read	Questions	Instruction	Demo	Level 1	Level 2	Level 3	Responsible	Proficient
1 - Orientation, Pre/Post-Flight										
I	1.1 Primary Flight Controls									
I	1.2 Secondary Flight Controls									
I	1.3 Using the Flight Instr.									
II	1.4 Ground Handling									
II	1.5 Preflight Inspection									
II	1.6 Positive Control Check									
II	1.7 Tow Rope Inspection									
III	1.8 Securing the Glider									
III	1.9 Area Familiarization									
2 - Takeoffs										
I	2.1 Takeoff Checklist									
I	2.2 Takeoff Proc. and Signals									
I	2.3 Takeoff									
II	2.4 Crosswind Takeoff									
III	2.5 T.O. w/o a Wing Runner									
III	2.6 Downwind Takeoff									
III	2.7 High Density Altitude T.O.									
3 - Aerotow										
I	3.1 Intro. to Flying the Tow									
I	3.2 Flying the Tow									
I	3.3 Release from Tow									
I	3.4 "Soft" Release (Optional)									
II	3.5 Shifting Through Wake									
II	3.6 Steering Turns									
II	3.7 Aerotow Signals									
II	Speed Up									
II	Slow Down									
II	Glider Release Failure									
II	Rudder Waggle									
II	3.8 Boxing the Wake									
II	3.9 Slack Rope on Tow									
II	3.10 Slack Rope in a Turn									
4 - In-Flight Maneuvers										
I	4.1 Transferring Control									
I	4.2 Scanning for Traffic									
I	4.3 Pitch/Speed Control									
I	4.4 Using the Trim Control									
I	4.5 Shallow/Med. Bank Turns									
I	4.6 Precision Turns									
I	4.7 Airbrakes in Flight									
II	4.8 Steep Turns									
II	4.9 Circling Flight									
II	4.10 Crabbing									
II	4.11 Stalls in Level Flight									
II	4.12 Stalls in a Turn									
II	4.13 Slow Flight									
II	4.14 Stalls with Airbrakes									
II	4.15 Side Slip - Alignment									
II	4.16 Side Slip - Crosswind									
II	4.17 Forward Slip									
II	4.18 Low-G Maneuvers									

Completion of Phases I and II required before solo.

		Read	Questions	Instruction	Demo	Level 1	Level 2	Level 3	Responsible	Proficient
4 - In-Flight Maneuvers (Cont.)										
III	4.19 Selecting Cruise Airpeed									
III	4.20 Deep Stalls									
III	4.21 Chandelle									
III	4.22 Incipient Spins									
III	4.23 Spins									
III	4.24 Rapid Speed Changes									
III	4.25 High-Speed Flight									
5 - Landing Patterns										
I	5.1 Landing Checklist									
I	5.2 Intro. to the Pattern									
I	5.3 Glide Slope Control									
II	5.4 Radio Use									
II	5.5 Crosswind Patterns									
II	5.6 Unusual Patterns									
II	5.7 Forward Slip w/Airbrakes									
II	5.8 Turning Slips									
II	5.9 Side Slip in the Pattern									
III	5.10 No Altimeter Pattern									
III	5.11 No Alt./Airspeed Pattern									
III	5.12 No Airbrake Pattern									
III	5.13 Full Airbrake Pattern									
6 - Landings										
I	6.1 Intro. to the Landing									
II	6.2 Precision Landings									
II	6.3 Crosswind Landings									
III	6.4 Landing Over an Obstacle									
III	6.5 Sim. Off-Field Landing									
III	6.6 Downwind Landings									
III	6.7 High Wind Landings									
III	6.8 High Altitude Landings									
7 - Flying in Lift										
II	7.1 Thermaling									
II	7.2 Mountain Wave									
II	7.3 Ridge Lift									
II	7.4 Convergence/Shear									
8 - Emergency Procedures										
II	8.1 Premature Tow Release									
II	8.2 Simulated Rope Breaks:									
II	Straight Ahead									
II	180° Turn									
II	Abbreviated Pattern									
II	8.3 Rock Off									
II	8.4 Power Loss During T.O.									
II	8.5 Power Loss at Altitude									
II	8.6 Simult. Release Failure									
II	8.7 Spiral Dive Recovery									
III	8.8 Unusual Attitude Recovery									
III	8.9 Intercept Procedures									
9 - Aeronautical Decision Making										
II	9.1 Situational Awareness									
II	9.2 Judgment									
II	9.3 Self-Discipline									

Student Name:_____

			Read	Review Questions	Instruction	Demonstrated	Level 1	Level 2	Level 3	Responsible	Proficient
1 - Orientation, Pre-Flight, Post-Flight											
I	1.1	Primary Flight Controls									
	1.2	Secondary Flight Controls									
	1.3	Using the Flight Instruments									
II	1.4	Ground Handling									
	1.5	Preflight Inspection									
	1.6	Positive Control Check									
	1.7	Tow Rope Inspection									
III	1.8	Securing the Glider									
	1.9	Area Familiarization									
2 - Takeoffs											
I	2.1	Takeoff Checklist									
	2.2	Takeoff Procedures and Signals									
	2.3	Takeoff									
II	2.4	Crosswind Takeoff									
III	2.5	Takeoff Without a Wing Runner									
	2.6	Downwind Takeoff									
	2.7	High Density Altitude Takeoff									
3 - Aerotow											
I	3.1	Introduction to Flying the Aerotow									
	3.2	Flying the Aerotow with Stick and Rudder									
	3.3	Release from Tow									
	3.4	"Soft" Release (Optional)									
II	3.5	Shifting Through the Wake									
	3.6	Steering Turns									
	3.7	Aerotow Signals									
	3.8	Boxing the Wake									
	3.9	Slack Rope on Tow									
	3.10	Slack Rope in a Turn									
4 - In-Flight Maneuvers											
I	4.1	Transferring Control of the Glider									
	4.2	Scanning for Traffic									
	4.3	Pitch/Speed Control									
	4.4	Using the Trim Control									
	4.5	Shallow/Medium Bank Turns									
	4.6	Precision Turns									
	4.7	Airbrakes in Flight									
II	4.8	Steep Turns									
	4.9	Circling Flight									
	4.10	Crabbing During Cruising Flight									
	4.11	Stall Recognition and Recovery in Level Flight									
	4.12	Stall Recognition and Recovery in a Turn									
	4.13	Slow Flight									
	4.14	Stall Recognition and Recovery with Airbrakes									
	4.15	Side Slip - Correcting for Alignment Errors									
	4.16	Side Slip - Compensating for a Crosswind									
	4.17	Forward Slip									
	4.18	Low-G Maneuvers									

Completion of Phases I and II required before solo.

			Read	Questions	Instruction	Demonstrated	Level 1	Level 2	Level 3	Responsible	Proficient
III	4.19	Selecting a Cruise Airspeed									
	4.20	Deep Stall Recognition and Recovery									
	4.21	Chandelle									
	4.22	Incipient Spin Recognition and Recovery									
	4.23	Spin Recognition and Recovery									
	4.24	Rapid Speed Changes									
	4.25	High-Speed Flight									

5 - Landing Patterns

I	5.1	Landing Checklist									
	5.2	Introduction to the Landing Pattern									
	5.3	Glide Slope Control Using the Airbrakes									
II	5.4	Radio Use									
	5.5	Crosswind Patterns									
	5.6	Unusual Patterns									
	5.7	Forward Slip with Airbrakes									
	5.8	Turning Slips									
	5.9	Side Slip in the Pattern									
III	5.10	No Altimeter Pattern									
	5.11	No Altimeter/Airspeed Pattern									
	5.12	No Airbrake Pattern									
	5.13	Full Airbrake Pattern									

6 - Landings

I	6.1	Introduction to the Landing									
II	6.2	Precision Landings									
	6.3	Crosswind Landings									
III	6.4	Landing Over an Obstacle									
	6.5	Simulated Off-Field Landing									
	6.6	Downwind Landings									
	6.7	High Wind Landings									
	6.8	High Density Altitude Landings									

7 - Flying in Lift

II	7.1	Thermaling									
	7.2	Mountain Wave									
	7.3	Ridge Lift									
	7.4	Convergence/Shear									

8 - Emergency Procedures

II	8.1	Introduction to Premature Aerotow Release									
	8.2	Simulated Rope Breaks:									
		Straight Ahead									
		180°									
		Abbreviated Pattern									
	8.3	Rock Off									
	8.4	Tow Plane Power Loss During Takeoff									
	8.5	Tow Plane Power Loss at Altitude									
	8.6	Simultaneous Release Failure									
	8.7	Spiral Dive Recovery									
III	8.8	Unusual Attitude Recovery									
	8.9	Intercept Procedures									

9 - Aeronautical Decision Making

II	9.1	Situational Awareness									
	9.2	Judgment									
	9.3	Self-Discipline									

Completion of Phases I and II required before solo.

FLIGHT TRAINING MANUAL FOR GLIDERS

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In any discrepancy between the information presented in this book and the FARs (Title 14 of the Code of Federal Regulations), or the AIM (Aeronautical Information Manual), the FARs and AIM are to be considered the final authority.

TABLE OF CONTENTS

INTRODUCTION

Glider pilot training can be divided into two parts; knowledge training and flight training. Knowledge training includes topics such as aerodynamics, weather, regulations, and airspace, and is covered by this book's companion, the *Glider Pilot's Handbook of Aeronautical Knowledge*. Flight training, covered in this manual, teaches the student to perform the maneuvers required to safely pilot a glider, such as takeoffs, flying the aerotow, circling flight, and landing.

This manual was written specifically for students pursuing a Private Pilot Certificate with a Glider rating, although it is a useful aid for preparing for a Commercial or Instructor rating as well.

Using This Manual

Each chapter of this manual addresses a separate stage of flight, such as takeoff, aerotow, or landing. Each chapter is divided into lessons that cover a specific task, skill, or maneuver. You will typically cover lessons from various chapters during a single flight training session.

Each lesson is explained in four parts (with the exception of a few lessons which do not include a list of common errors). The "purpose" outlines the relevance of the task or skill. The "procedure" describes the task or skill in detail. The list of "common errors" points out the usual pitfalls. The "completion standard" is the performance criterion that must be met for the lesson to be considered mastered.

The training is divided into three phases. Upon completion of Phase 1, you will be able to perform a complete flight unaided, including takeoff, tow, pattern, and landing. When you complete Phase 2, you are ready to solo, and when you complete Phase 3, you are ready to get your license.

The Flight Instructor

You will receive your flight instruction from a Certified Flight Instructor in Gliders (CFI-G). This certification is given by the Federal Aviation Administration (FAA).

Good flight instructors are organized, patient, adaptable, creative, conservative, and modest.

Good organizational skills allow the instructor to make efficient use of time and equipment. At the end of each lesson, the instructor should provide you with a plan for the following lesson, so that you know what material to study.

Patience helps the instructor to work with different types of students and to teach effectively. Should a student have difficulty grasping a concept or performing a maneuver, the instructor must be able to adapt and change the way the concept or maneuver is being taught. Being creative allows the instructor to present the material in different ways.

A good flight instructor is also a conservative pilot, not a "risk taker". Instructors should never need to show off or purposely get into difficult situations just to prove their skills. To do so is a sign of immaturity and poor judgment.

Finally, and most importantly, a good flight instructor is modest. Modest instructors are able to question their own methods when they are not producing the desired results, and therefore adapt. A modest instructor is still capable of learning.

If multiple instructors are available where you will receive flight training, do not hesitate to get to know them all, so you can choose one suited to your personality and learning style.

The Student

To be a good student you should be prepared, focused, and receptive to hearing what your instructor has to say.

You should prepare for a training session by studying the assigned lessons. You should note any questions you have about the material and bring them to your instructor's attention.

To be focused during training sessions, you should arrive on time and avoid being rushed or distracted. You should also be rested and not hungry or thirsty.

Most importantly, you should be able to listen to and accept the instructor's critique of your performance. The best students acknowledge and learn from their mistakes instead of making excuses or giving reasons for poor performance.

The instructor's primary goal is to train you to be a competent and safe pilot. The secondary goal is to complete the training as quickly (and inexpensively) as possible. Therefore, each time you master a maneuver, the instructor will assign another. Of course, you will usually be "incompetent" at any newly assigned maneuver. This may sometimes make you feel as though you are not making progress. Keep this in mind during your training. Don't focus on the difficulty you are having with the latest maneuver; instead, consider the list of maneuvers you *have* mastered. If you remember this, you will be less likely to get too frustrated during your training.

The Flight Training Process

In most training sessions, you will practice previously learned skills and learn new ones. When learning a new skill or maneuver, you should read and study the appropriate material, and be prepared to answer either written or oral questions regarding it to demonstrate to your instructor that you understand the information. Your instructor will clear up any confusion and answer any questions you have before the flight.

In the air, your instructor will demonstrate the proper execution of the maneuver described in the lesson. You will then try to perform the maneuver. The learning process can be divided into three stages: experimentation, practice, and mastery. During the experimentation stage, you are learning the cause and effect relationships between the glider and the controls. Once you have a "feel" for these relationships, you can start to practice the maneuver. Finally, you will develop the automatic reactions that indicate the skill has been "hardwired" and mastery of it has been achieved. You may progress through all three stages during a single training session, or you may need several sessions, depending on the difficulty of the maneuver.

After each attempt at the maneuver, your instructor will critique your performance. The critique will include both what you did right, as well as suggestions on how to improve.

At different points in your training, your instructor may require you to re-demonstrate mastery of a previous lesson. The instructor may set up a flight situation to this end, and may or may not warn you beforehand. These "surprise" evaluations will become more frequent as you near the end of your training.

Flight Training Progress Record

Inside the front cover of this manual you will find a list of topics titled "Flight Training Progress Record". The progress record includes every skill or maneuver that the student must master before taking the Private Pilot Practical Test, often referred to as the "flight test". For every topic in the progress record, there is a corresponding lesson in this manual.

Included with this manual you will also find a Flight Training Progress Record card that can be carried by your instructor in the glider during your lessons. The Flight Training Progress Record card allows the instructor(s) to keep accurate records on each student, including all the information required by the FAA.

Extra copies of both versions of the Flight Training Progress Record can be downloaded for free from **www.GliderBooks.com**.

Following are guidelines for using the check boxes on the Flight Training Progress Records:

Read – The instructor should circle this box when the lesson is assigned as homework. The student marks this box as completed after reading about this lesson in the *Flight Training Manual for Gliders.*

Review Questions – The student should mark this box after completing the review questions for this lesson.

Instruction – The instructor should mark this box after reviewing/correcting the student's answers, and giving the student ground instruction about the lesson.

Demonstrated – The instructor should mark this after demonstrating the lesson to the student.

Level 1 – The instructor should mark this box when the student understands/observes the errors being made, but is not yet able to take the proper actions to correct them.

Level 2 – The instructor should mark this box when the student understands/observes the errors being made, and understands the actions that need to be taken to correct the errors, even if the student cannot consistently perform those actions.

Level 3 – The instructor should mark this box when the student understands/observes the errors being made, understands the actions that need to be taken to correct the errors, and can consistently perform those actions.

Responsible – The instructor should mark this box when the student is responsible for performing the maneuver covered in this lesson at the appropriate time during the flight without prompting from the instructor.

Proficient – The instructor should mark this box when the student consistently performs the action/maneuver covered in this lesson at the level required to meet the Practical Test Standards.

Practical Test Preparation Progress Record

The FAA publishes a book called the *Private Pilot Practical Test Standards for Glider* (PTS). The PTS describes the areas of operation and the tasks within those areas that the examiner will cover during the practical test (i.e., the "flight" test). It also lists the minimum performance required to successfully complete each task. Students should be familiar with the PTS before taking the practical test. The PTS is available to be downloaded for free from the FAA website.

As the last step in the training process, the instructor and the student will go through each area of operation and task required by the PTS. The Practical Test Preparation Progress Record is used to document this last step. Note that not all of the tasks are required for transition pilots. The Practical Test Preparation Progress Record can be downloaded for free from **www.GliderBooks.com**.

Additional Materials

The instructor will provide you with the following information specific to your home gliderport and the glider used for training:

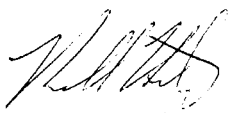
- Gliderport Standard Operating Procedures (SOP's)
- Glider nomenclature
- Preflight inspection checklist
- Area landmarks
- Local traffic patterns
- Local radio procedures
- Local convergence zones (if applicable)
- Local rope break procedures

This information may be provided in the form of a printed handout, or given verbally.

Your Feedback

We are very interested in getting your feedback on the books. The *Glider Pilot's Handbook of Aeronautical Knowledge* and the *Flight Training Manual for Gliders* are printed in small quantities to give us the ability to quickly incorporate corrections and revisions suggested by both students and instructors. Our desire is to have the textbooks evolve into a tool that will make the training process quicker, cheaper, more thorough, and more enjoyable, both for the student and the instructor. You can email the author directly at Russell@GliderBooks.com.

Thank you for choosing our books!



Russell Holtz

About the Author

Russell Holtz grew up in Tulsa, Oklahoma, and attended the Massachusetts Institute of Technology, where he earned a Bachelor of Science degree in Aeronautical and Astronautical Engineering.

He obtained his Private Pilot Certificate in gliders in 1995, in airplanes in 1996, his Commercial Certificate in Gliders in 1998, and his Certified Flight Instructor rating in gliders in 1999.

He completed the FAI Silver Badge requirements in 1997, and the Gold and Diamond requirements in 1998.

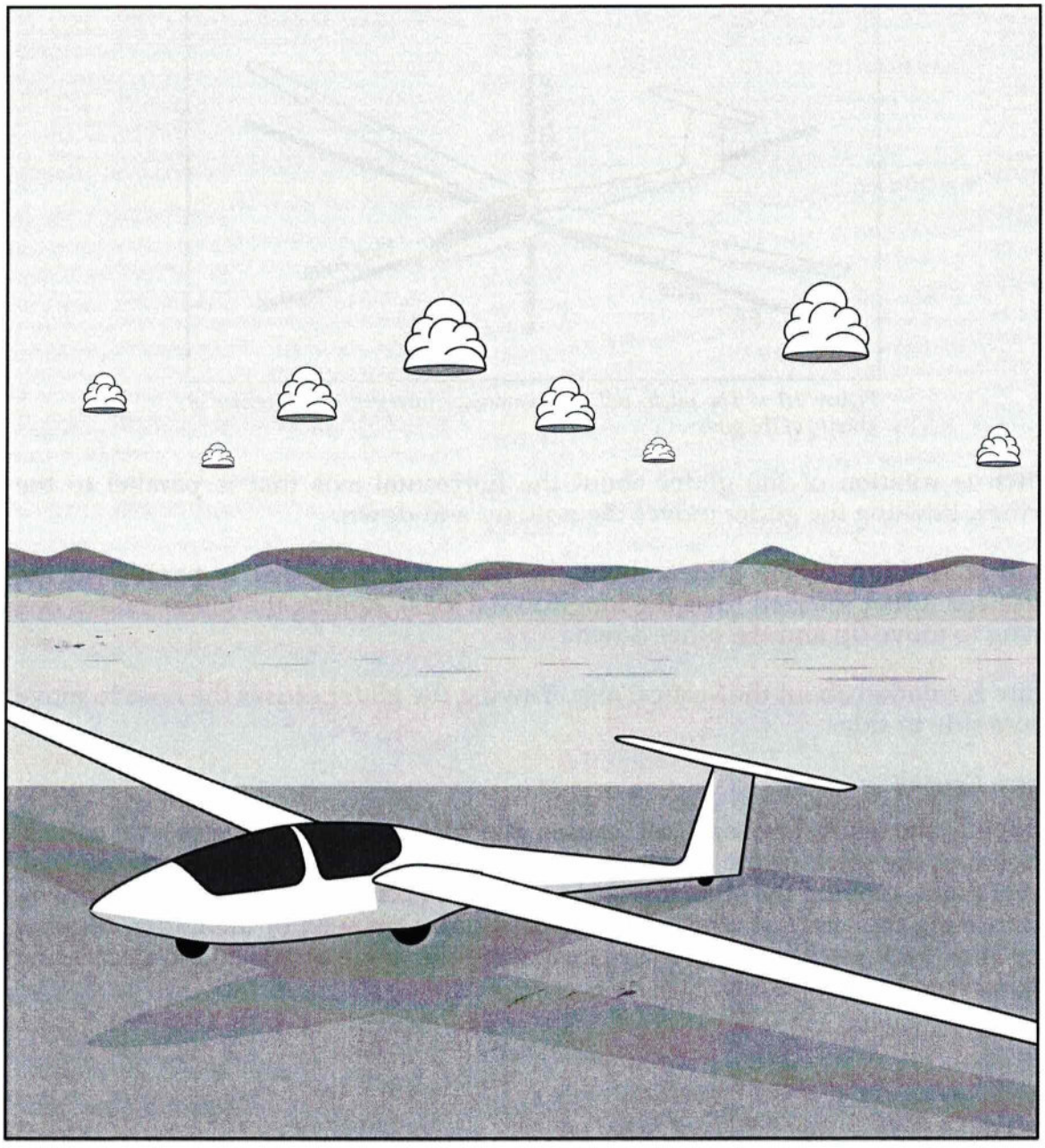
Russell has given over 2,500 hours of instruction, including primary, cross-country, contest, and aerobatics, and has over 4,000 hours total time in gliders.

In 2000, he helped to create the Youth Soaring Academy in Hollister, California, and was the volunteer instructor for the organization from 2000 until 2004. Most of the material in this book was first developed for presentation to the Hollister YSA students.

Since then, Russell has been instructing at various glider operations in California and Nevada.

CHAPTER 1: ORIENTATION, PRE-FLIGHT, POST-FLIGHT

You must learn some basic information before you can take to the air. In this chapter, you will learn about the glider's controls and instruments, how to inspect the glider and towrope, how to move the glider around on the ground, and how to secure the glider when you are finished with it.



1.1 Primary Flight Controls

Purpose

In this lesson, you will learn the names, locations, and effects of the glider's primary flight controls.

Procedure

The primary flight controls consist of the stick and rudder pedals. They control the movement of the glider about its three axes: pitch, roll, and yaw.

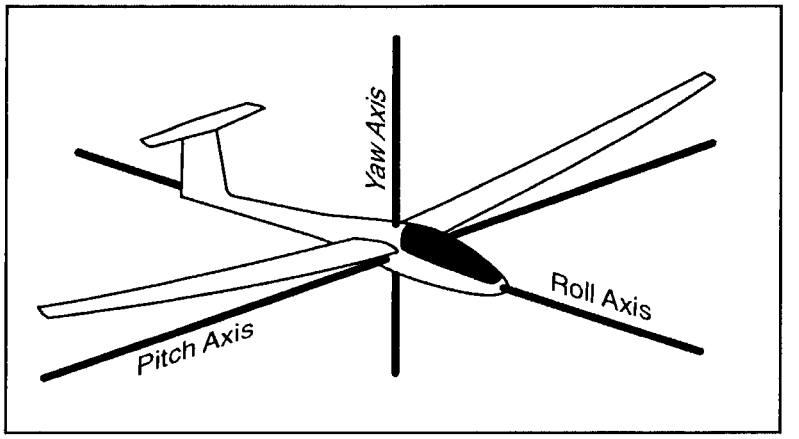


Figure 1.1 – The pitch, roll, and yaw axes intersect at the center of gravity of the glider.

Pitch is rotation of the glider about the horizontal axis that is parallel to the wings. Pitching the glider moves the nose up and down.

Roll is rotation of the glider about the horizontal axis that is parallel to the fuselage (often referred to as the longitudinal axis). Rolling the glider causes one wing to move up and the other down.

Yaw is rotation about the vertical axis. Yawing the glider causes the nose to move from side to side.

Pitch Control

Moving the stick fore and aft causes the elevator (or stabilator) to deflect, changing the pitch of the glider and the angle of attack of the wing. In normal, level flight, moving the stick forward causes the nose of the glider to pitch down, decreasing the angle of attack and increasing the airspeed of the glider. Moving the stick back pitches the nose up, increasing the angle of attack and decreasing the airspeed of the glider.

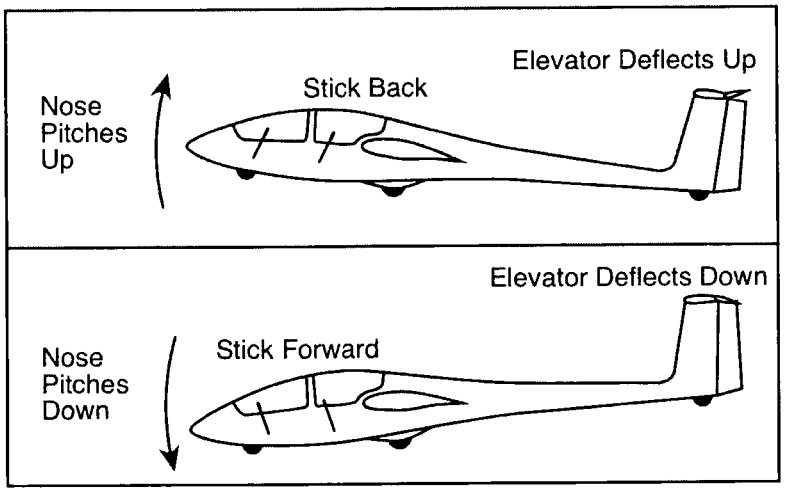


Figure 1.2 – The elevator controls pitch.

In later lessons, you will learn that when the glider is stalled, it will not necessarily react to control inputs the same way it does when in normal flight.

Roll Control

Moving the stick from side to side deflects the ailerons, causing the glider to roll. When the stick is moved to the right, the right aileron moves up and the left aileron moves down, causing the glider to roll to the right.

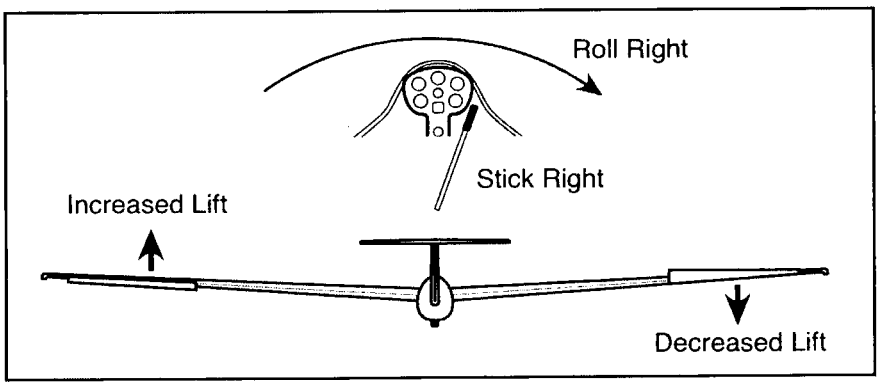


Figure 1.3 – The ailerons control roll.

Because gliders have such long wings, the response to the ailerons tends to be a bit sluggish, especially at low airspeeds.

When the ailerons are deflected, the wing that creates more lift also creates more induced drag. This causes the glider to yaw opposite the direction that the stick is moved. This tendency is called adverse yaw. (See Chapter 3: Glider Aerodynamics in the *Glider Pilot's Manual of Aeronautical Knowledge.*) The rudder must be used to counteract adverse yaw.

Yaw Control

The rudder pedals control the glider about the yaw axis. Pushing on the right rudder deflects the rudder to the right, forcing the nose to the right, and vice versa.

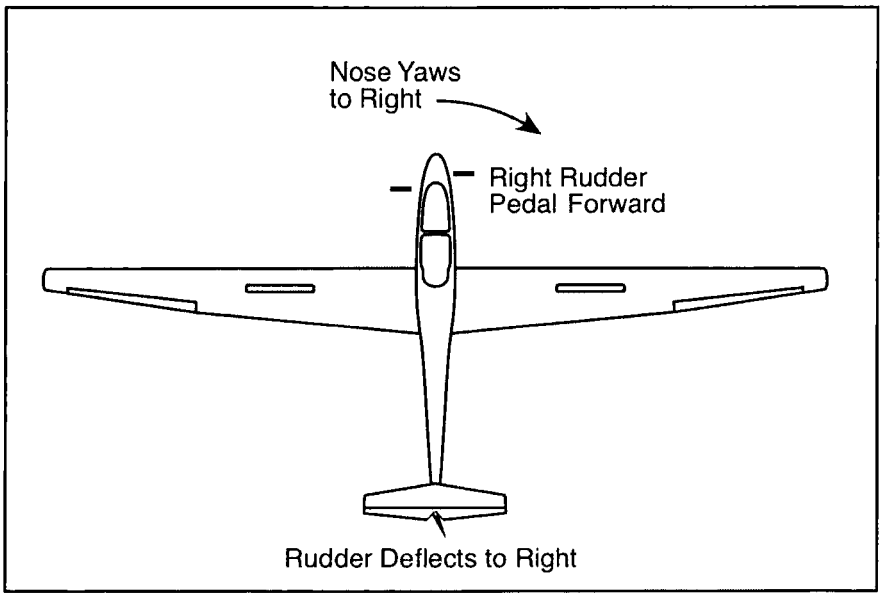


Figure 1.4 – The rudder controls yaw.

Again, the long wings of a glider tend to make it respond to the rudder rather slowly. The glider will tend to oscillate in yaw because of the momentum of the wings and the relatively small amount of damping provided by the vertical stabilizer.

Completion Standard

This lesson is complete when you can locate and describe the effects of the stick and rudder pedals.

1.2 Secondary Flight Controls

Purpose

In this lesson, you will learn about the remaining flight controls, including the towrope release, the airbrakes, the wheel brake, and the elevator trim. If the glider you are using for flight training is equipped with a retractable undercarriage or flaps, the location and use of their controls will also be covered in this lesson.

Procedure

Towrope Release

The tow hook is opened by the towrope release knob. This knob is usually located on the instrument panel or on the left side of the glider. Your instructor will show you the location of the towrope release knob in the glider that you will use for training.

Airbrakes

The airbrakes are used for glide slope control. In this manual, the term "airbrakes" will be used to refer to both dive brakes and spoilers. The airbrakes are used to control the glide path of the glider. For a steeper path, you use more airbrakes.

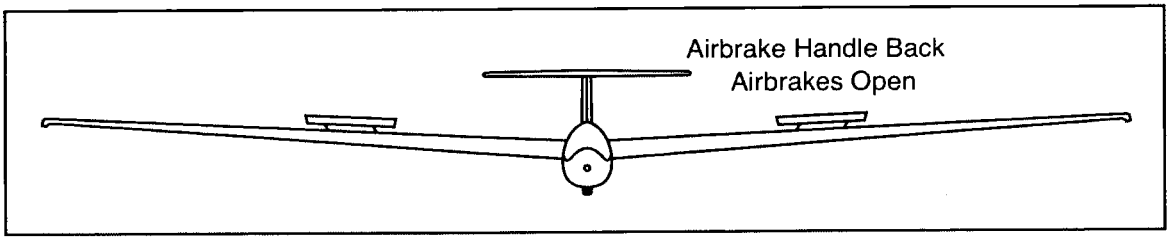


Figure 1.5 – As the airbrake handle is pulled back, the airbrakes open. The airbrakes control the glide path. On most gliders, pulling the airbrakes all the way open engages the wheel brake.

The airbrakes are deployed by moving the airbrake handle. The airbrake handle is usually located on the left side of the glider. Your instructor will demonstrate how to unlock and deploy the airbrakes. On many gliders, pulling the airbrake handle all the way back engages the wheel brake. On others, the wheel brake is activated by a lever mounted on the control stick, or elsewhere in the cockpit.

Elevator Trim

The elevator trim is used to set the airspeed at which the glider will fly when no fore or aft force is applied to the control stick. Your instructor will show you the location and function of the trim control on the glider you are using for your training.

Flaps

Some gliders have flaps that decrease the stall speed by increasing the amount of lift that the wing can produce. Flaps can also be used to decrease the drag at high airspeeds. If your glider is equipped with flaps, your instructor will show you the location and function of the flap control.

Undercarriage

Some gliders have retractable landing gear (also referred to as the undercarriage) for decreasing drag during flight. If your glider is so equipped, your instructor will explain the procedure for retracting and lowering the gear.

Completion Standard

This lesson is complete when you can locate and describe the use of the towrope release, airbrakes, wheel brake, and trim controls, and if the training glider is so equipped, the flaps and undercarriage controls.

1.3 Using the Flight Instruments

Purpose

The airspeed indicator, altimeter, variometer, yaw string, and compass are the primary instruments you use to understand the glider's position and movement through the air. It is crucial that you understand how these instruments are adjusted and how to interpret the information they provide. How the instruments work is covered in Chapter 5: Flight Instruments and Systems, of the *Glider Pilot's Handbook of Aeronautical Knowledge.*

Procedure

Figure 1.6 shows a typical glider instrument panel.

Figure 1.6 – Typical glider instrument panel, with (from L to R) a radio, an airspeed indicator, a variometer, an altimeter, and a compass (lower center).

Altimeter

The altimeter measures static pressure, which decreases with increasing altitude. Since weather systems can also affect the static pressure, the altimeter is equipped with an adjustment knob that is used to set the altimeter for current atmospheric conditions.

The altimeter has three "hands", as shown in Figure 1.7. Hand "A" indicates hundreds of feet, hand "B" indicates thousands of feet, and hand "C" indicates tens of thousands of feet. The altimeter in the figure indicates an altitude of 1,400 feet.

Figure 1.7 – Altimeter

The Kollsman window shows the atmospheric pressure (about 29.90 inches of mercury in this case). The knob at the lower left side of the altimeter is used to adjust for changes in atmospheric pressure. Before takeoff, you should adjust the altimeter so that the Kollsman window shows the local pressure, if known. If the local pressure is not known, adjust the altimeter so that it indicates the field elevation.

If you obtain an updated pressure reading while in flight, you can adjust the pressure indicated in the Kollsman window accordingly.

Airspeed Indicator

The airspeed indicator measures the speed of the glider through the air. The airspeed indicator only reports the true airspeed when at sea level under standard conditions. Temperature and pressure (i.e., altitude) affect the accuracy of the airspeed indicator. At high temperatures and high elevations, the indicated airspeed will be lower than the true airspeed.

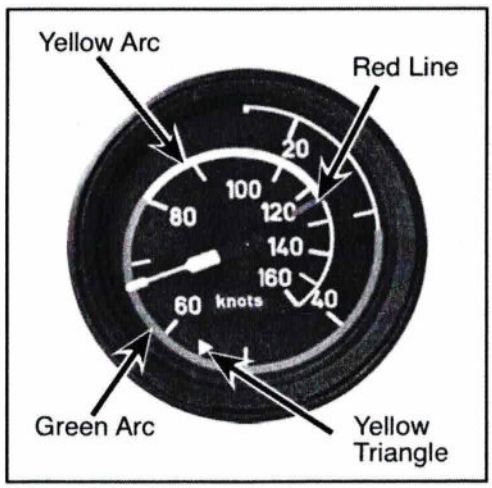


Figure 1.8 – Airspeed indicator

Many airspeed indicators have markings that indicate important airspeeds. The minimum recommended approach airspeed is indicated by a yellow triangle (56 knots for the airspeed indicator in Figure 1.8). The normal operating range of the glider is indicated by a green arc. The stall speed during straight and level flight at the glider's maximum gross weight is indicated by the bottom of the green arc (32 knots), and the maximum structural cruising speed is indicated by the top of the green arc (80 knots). The caution range is indicated by a yellow arc. The never-exceed speed is shown by a red line (124 knots). Of course, the white needle indicates the current airspeed, about 68 knots in this case.

Variometer

The variometer can be uncompensated (attached directly to the static ports of the glider), total energy compensated (attached to a total energy probe), or NETTO compensated (either mechanically or electronically). How you interpret the output of the vario depends on how it is compensated.

Figure 1.9 – Variometer

If the variometer is uncompensated, it will indicate the actual sink or climb rate of the glider with respect to the ground.

If the variometer is total energy compensated, it will indicate the rate at which the glider would be sinking or climbing if it were being flown at a constant airspeed.

If the variometer is NETTO compensated, it will indicate the vertical movement of the air mass in which the glider is flying.

Electronic variometers often have audio output. The audio output allows you to monitor your climb rate without having to look at the variometer. You should refer to your variometer manual for instructions on interpreting the noises that it makes.

Electronic variometers often take some time to warm up; you should turn on the variometer several minutes before you plan to launch the glider.

Yaw String

The yaw string is simply a piece of yarn taped to the outside of the canopy. It shows how accurately the glider is aligned with the airflow.

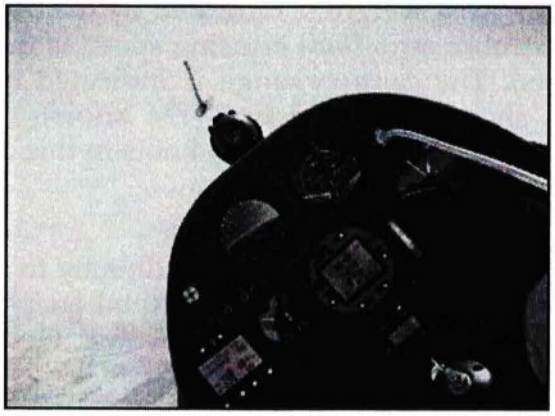


Figure 1.10 – Yaw string

If the yaw string is not pointing straight back, the glider is moving sideways through the air. To keep the glider aligned with the yaw string, and therefore the airflow, use the rudder.

Compass

The compass indicates your heading with respect to magnetic north. The compass is susceptible to a host of errors, and is typically only accurate during straight, unaccelerated flight.

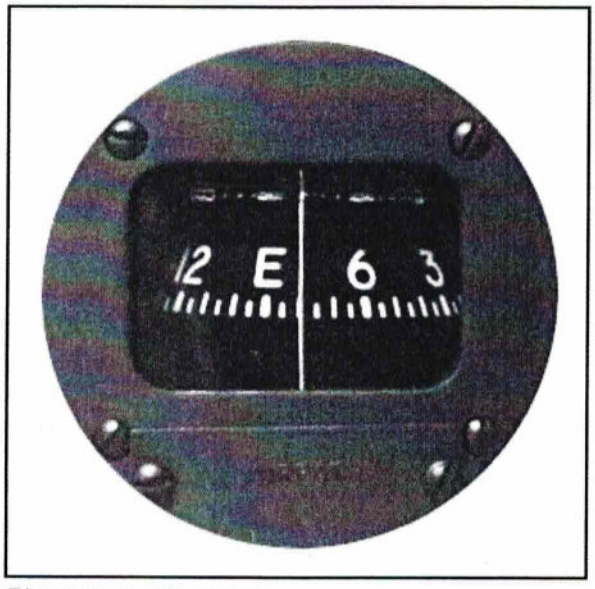


Figure 1.11 – Compass

The compass in Figure 1.11 indicates a heading of 80°. This means the glider's nose is pointed 80° to the right of magnetic north.

When trying to turn to a desired compass heading, keep in mind that the compass card remains fixed with respect to magnetic north, and the glider rotates around it. For the compass shown in Figure 1.11 to be on an east (i.e., 90°) heading, the pilot would need to turn 10° to the right.

Completion Standard

This lesson is complete when you can correctly interpret the information provided by each instrument in the glider.

1.4 Ground Handling

Purpose

While gliders are built to handle the strong forces encountered in flight, they are relatively fragile on the ground and must be handled with care. In this lesson, you will learn how to safely move the glider around the gliderport.

Procedure

Your instructor will assist you in moving the glider from the tie-down area to the staging area before your lesson, and from the runway back to the tie-down area afterward.

Typically, two people are needed to safely move a glider. One person "walks the tip", holding the wings level but not pushing or pulling, while the other does the work of moving the glider. The person doing the work can either push the glider backwards, from either the nose or the leading edge of the wing, or pull it forward by gripping the edge of the cockpit with the canopy open. (In light winds, one person can move the glider if it is equipped with wing tip wheels.)

If a vehicle and towrope are used to move the glider, one person should walk the wing tip and another should either walk next to the fuselage of the glider or sit in the glider so that they can stop the glider if necessary to avoid overtaking the tow vehicle. The tow vehicle should never pull the glider faster than walking speed, and the towrope should be longer than one-half the span of the glider.

Always keep the wind in mind when moving the glider on the ground. Always try to keep the glider's nose pointed into the wind if possible.

Also, keep in mind what the wind will do to the canopy if you are moving the glider with the canopy open. Try to keep the glider oriented so that the wind does not blow the canopy closed. When changing directions or rotating the glider, keep in mind how the new orientation of the wind will affect the canopy.

Unless you need access to the cockpit of the glider, you should have the canopy closed and latched. The wind, or the prop blast from an airplane, can damage an open canopy by slamming it closed.

Never push or pull by the wing tips to move the glider. The wing is built to handle large loads up and down but is relatively weak fore and aft.

Unless equipped with a swiveling tail wheel or tail dolly, the glider should rest only on the main wheel when turning. Depending on how the glider is balanced, you will either have to raise or lower the nose to make sure only the main wheel is in contact with the ground when the glider is rotated or turned.

Don't push on control surfaces or trailing edges of the wing. These areas are easily damaged.

Always be in a position to stop the glider. A collision with other aircraft or fixed objects, even at very low speeds, can damage the glider. In high winds, have someone on the upwind wing to keep that wing low. In very strong winds, it is useful to have someone in the glider operating the controls to help keep the wings level and the glider on the ground.

Always have someone walk a wing tip that might hit an obstacle. It is difficult to tell from 50 or 60 feet away whether the wing will clear the obstruction. Instead of taking chances, have a person walk the tip nearest to any obstacle.

Common Errors

- Trying to rotate the glider when it is resting on both its main and tail wheels, or main and nose wheels
- Not having a way to stop the glider
- Hitting or almost hitting objects with the wing tip of the glider
- Pushing the glider by the wing tips
- Leaving the canopy open when the glider is unattended

Completion Standard

This lesson is complete when you can safely move the glider (with a helper) without instructor supervision.

1.5 Preflight Inspection

Purpose

To ensure that the glider is airworthy, you must inspect it before each flying session. In this lesson, you will learn how to inspect the glider and prepare it for flight.

Procedure

Checklists are used to prevent minor oversights from turning into major problems. When using a checklist, it is important that you take the time to think about each item on the list. You should not simply mouth the words on the list then move on, or you may overlook important items.

If you encounter an item on the checklist that requires special attention, attend to it right when you notice it. Do not put it off until later, or you may forget it. For example, if the checklist says to add ballast as necessary to be within the allowed center of gravity range, don't tell yourself that you will do that once you are done with the rest of the checklist. It is easy to get distracted and forget. If you perform items on the checklist out of order, you are undermining much of the usefulness of the checklist and unnecessarily increasing your risk.

Your instructor will walk you through a preflight inspection, using the written preflight checklist for the glider.

As you start performing the preflight inspection on your own, if you are ever unsure whether a defect you find is significant, you should ask your instructor or a mechanic before continuing with the checklist. Don't worry if at first you find yourself asking many questions. Only in this way will you be able to learn which defects are simply cosmetic, and which can affect the safety of the glider.

If spectators or other pilots try to converse with you during your preflight inspection, you should politely let them know that the task at hand demands your full attention. Many accidents have occurred because a pilot was distracted by questions from bystanders during a preflight inspection.

Common Errors

- Failure to use a written checklist
- Skipping items on the checklist
- Failure to address problems as they are encountered

Completion Standard

This lesson is complete when you can explain the significance of each item on the preflight checklist, and you can perform the preflight inspection unassisted.

1.6 Positive Control Check

Purpose

Since gliders are designed so they can be disassembled, the control linkages between the ailerons, airbrakes, flaps, and elevator are designed so they can be disconnected. To assure that the control linkages have been properly assembled and secured, you should always perform a positive control check before flying a glider that has been reassembled.

Procedure

Two people are required to perform a positive control check. One person moves a control, while the other person provides resistance against the movement of the control surface. When applying resistance to the control surface, the helper should apply force near where the push rod attaches to avoid bending the surface.

Any control that can be disconnected should be checked. This includes the two ailerons, the two airbrakes, and the elevator (and both flaps if present). Typically, you would start the positive control check with an aileron, move to the airbrakes, then the elevator, the opposite airbrake, and the opposite aileron.

When you check the ailerons, start out with the stick fully deflected to one side. Then move the stick to the other side, as your helper applies several pounds of force to the aileron to resist, but not prevent, the movement. Once the aileron is fully deflected, you should move the stick back to the starting point, while your helper again resists, but does not prevent the movement of the control surface.

You should use the same technique on the airbrakes and the elevator. Be careful not to pinch your helper's fingers when checking the airbrakes. Explain to your helper that you will try to close the airbrakes and that they should resist you, but that before the brakes are fully closed, you will open them again to allow them to get their fingers clear.

While you are performing the positive control check, also verify that the control surfaces are moving in the proper direction.

Common Errors

- Failure to perform a positive control check after assembling the glider
- Not moving the control surface through its full range of motion

Completion Standard

This lesson is complete when you can explain the importance of a positive control check and can perform one with the aid of a helper.

1.7 Towrope Inspection

Purpose

The towrope is a key piece of equipment. The glider pilot should treat the towrope the way a power pilot treats an engine. If it fails at a critical time, you could be left in quite a precarious situation.

Procedure

Your instructor will show you how to inspect the towrope. You should pay particular attention to the knot, which connects the towrope to the tow rings, and to any frayed or burnt-looking spots on the rope. Often, the heat generated as the rope drags on the runway will melt the rope and keep the rope from fraying, making damage harder to see.

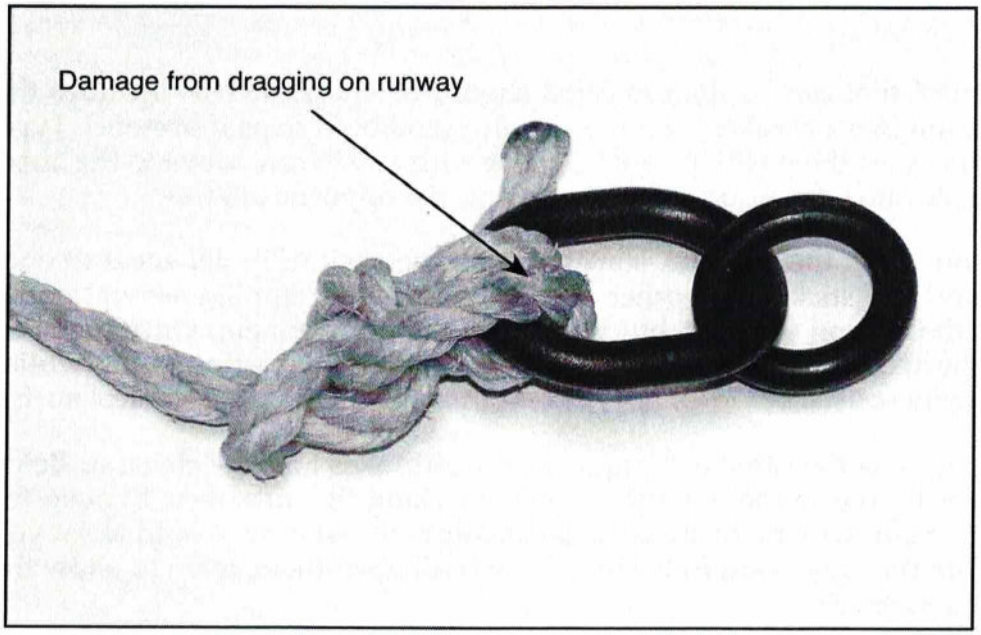


Figure 1.12 – The damage to the knot above could be easily overlooked. The damaged portion of the rope should be removed.

If the release is pulled when there is tension on the rope, the rope can spring forward and tie itself in a knot. If this knot is then dragged along the ground when the tow plane lands, a wear spot can develop. It is a good practice to check the rope before untying the knot so you know exactly where to look for damage.

Most gliderports use a three-stranded nylon towrope. If more than one-half of one strand is worn through, the rope should be replaced (or cut and retied if the damage is at the end of the rope).

The tow ring should also be inspected. If the ring is bent, cracked, or deformed, it should be replaced.

Common Errors

- Failure to inspect the towrope
- Just glancing at the rope without actually examining it

Completion Standard

This lesson is complete when you can determine whether a towrope is in usable condition.

1.8 Securing the Glider

Purpose

The glider is an expensive piece of equipment that is vulnerable to the wind and weather. In this lesson, you will learn to properly secure the glider after landing.

Procedure

Different gliderports have different methods for securing their gliders that are dependent on local conditions. Some just tie down the tips of the wings; others tie down the tips and the tail, and tie back the control stick with the seat belt. Your instructor will show you how to secure the glider at your gliderport.

Never tie back the backseat stick. If someone else were to try to fly the glider without noticing the backseat stick tied back, it would most likely lead to a serious accident.

In addition to tying the glider down, you may also need to remove the battery from the glider, remove any ballast, remove seat cushions, and install control locks and canopy covers. Once again, your instructor will explain the procedure at your gliderport.

Common Errors

- Failure to properly tie down the glider after flight
- Failure to properly secure the glider after flight

Completion Standard

This lesson is complete when you can explain and follow the proper procedures for securing the glider after flight.

1.9 Area Familiarization

Purpose

Even if you have plenty of altitude to make it back to the airport, it doesn't do you much good unless you can find the airport! In this lesson, you will learn the names and locations of landmarks, and their position with respect to your home airport.

Procedure

Your instructor will point out area landmarks both in the air, and on a map. Learn where each of the landmarks is located, what it is called, and where the airport is located with respect to the landmark. Your instructor will quiz you about the landmarks while flying.

Common Errors

- Not knowing where you are with respect to the airport

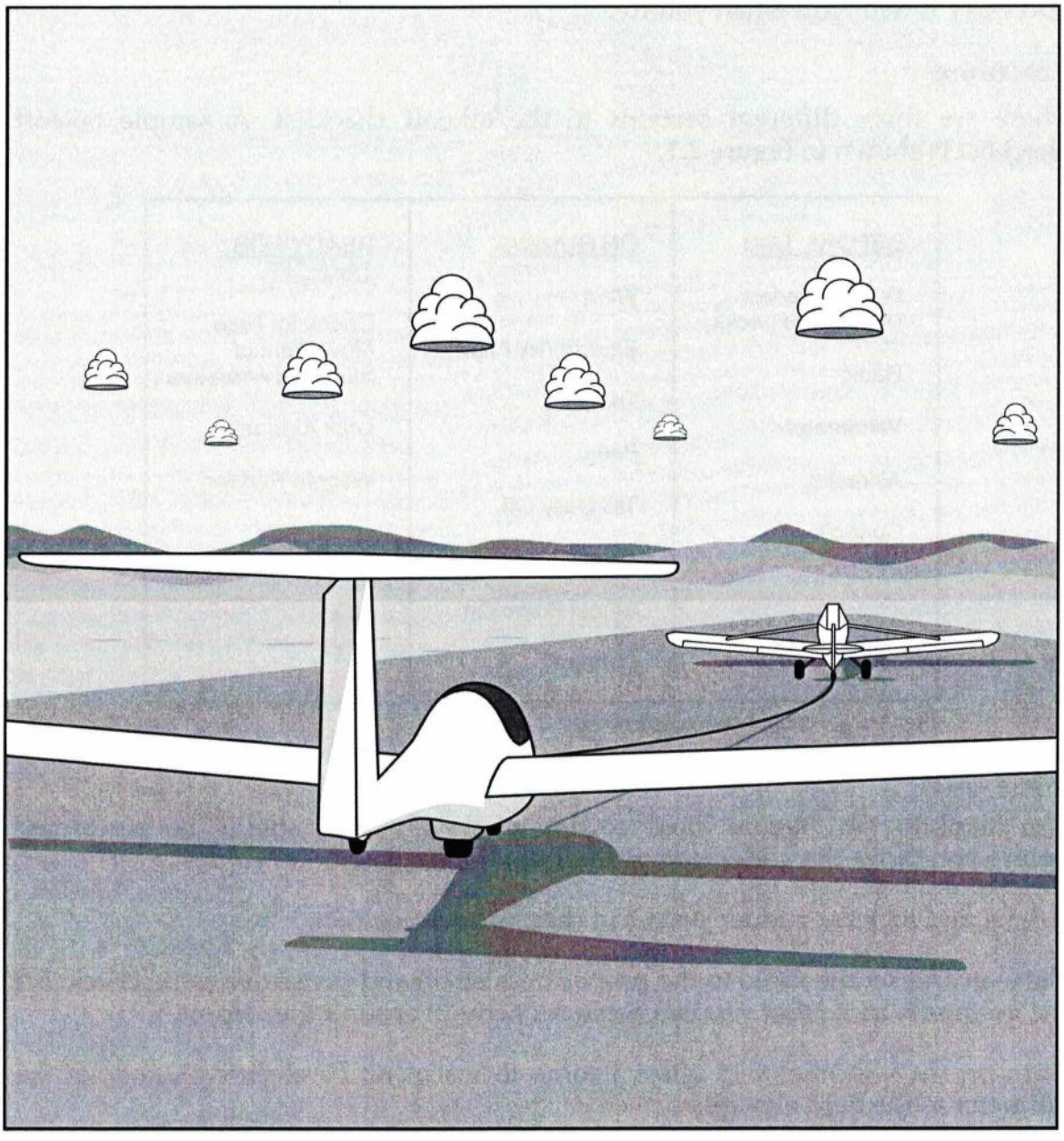
Completion Standard

This lesson is complete when you can name and locate area landmarks, and are always aware of your position relative to the airport.

CHAPTER 2: TAKEOFFS

The takeoff is one of the two most critical phases of flight, the other being the landing. The takeoff is unique, however, in that it is optional. If the conditions are unacceptable, the glider pilot should postpone or cancel the flight.

Because of the proximity of ground personnel to the tow plane and glider, careful coordination of the takeoff is required. In this chapter, you will learn how to prepare for takeoff and how to perform takeoffs in various conditions.



2.1 Takeoff Checklist

Purpose

Many accidents could be prevented if all pilots consistently used checklists. When overlooked, an apparently minor item, such as latching the canopy or locking the airbrakes, can create a significant hazard shortly after takeoff. In this lesson, you will get in the habit of going through a takeoff checklist before each flight.

Every glider should have its own takeoff checklist. If the glider you are using for training does not have a checklist posted in the cockpit, you can make your own and carry it with you when you fly.

Procedure

There are three different sections to the takeoff checklist. A sample takeoff checklist is shown in Figure 2.1.

BEFORE TAXI	ON RUNWAY	READY FOR TAKEOFF
Rudder Pedals (Adjust and Lock)	Wind	Check for Free Movement of Stick and Airbrakes
Radio	Emergency Plan	Lock Airbrakes
Variometer	Trim	Waggle Rudder
Altimeter	Belts	
Controls	Tail Dolly Off	
	Tow Rope	
	Wheel Brake On	
	Canopy	

Figure 2.1 – Sample takeoff checklist

Before Taxi

The items in the "Before Taxi" section of the checklist should be performed before you move the glider into position on the runway.

Adjust and lock the rudder pedals in their proper position.

Turn on and set the radio to the proper frequency, and perform a radio check. Set the volume high so that you can listen for activity around the airport.

Turn on the variometer to allow it time to warm up (if electrical), and set the altimeter to the field elevation.

Check the controls (stick, rudder, and airbrakes) for free movement throughout their range.

On Runway

This section of the checklist should be completed after you are positioned on the runway.

Check the wind, and then plan what you will do in case of a premature termination of the tow (see Lesson 8.1). During the beginning of your training, your instructor will be responsible for making this plan.

Set the trim in the takeoff position. Check that your seat belts and those of your instructor (or passenger) are secure. If your glider has a tail dolly, verify that it has been removed before allowing the towrope to be attached to the glider.

Once the towrope is attached, fully open the airbrakes to apply the wheel brake. This makes it clear to the tow pilot that you are not ready to take off, and keeps the glider from lurching forward and possibly hitting the line-person when the rope becomes tight.

You should then close and secure the canopy (or canopies). Check that the canopy is locked by trying to push it open. (Try this sometime when you know the canopy is unlocked to see how much force is required.)

Ready for Takeoff

The final part of the pre-takeoff checklist is used when you have checked for traffic and wind and are ready to go. At this point, perform a final check to make sure the stick and airbrake controls move freely throughout their full range. When you are ready to go, close and lock your airbrakes and give a thumbs-up to signal to the wing runner to level your wings, and then waggle the rudder to indicate to the tow pilot to start the takeoff.

Remember that any time you get distracted or have to stop a checklist, be sure to pick it up right where you left off, or if you are unsure of where you were, start it over.

Common Errors

- Failure to complete the checklist
- Skipping items on the list
- Failure to resume the checklist at the proper point after an interruption or distraction

Completion Standard

This lesson is complete when you consistently perform the pre-takeoff checklist before each flight without prompting from your instructor.

2.2 Takeoff Procedures and Signals

Purpose

For safety's sake, it is important that the launch proceed in an orderly fashion. There are a number of standard signals used for communication between the glider pilot, the tow plane pilot, and the wing runner during the launch. In this lesson, you will learn how and when to use these signals, both as the glider pilot and as the wing runner.

Procedure

Some gliderports use different signals or procedures than the ones given here. Make sure you are familiar with the signals and procedures used at your gliderport.

These procedures assume that a helper (referred to as the line-person) is present to hook up the towrope and run the wing of the glider during the takeoff. If a helper is not available, the procedures will have to be modified accordingly.

Inspecting/Connecting the Towrope

The line-person should show the glider pilot the towrope and ring before connecting the towrope to the glider. This gives the pilot a chance to inspect the rope, knot, and ring.

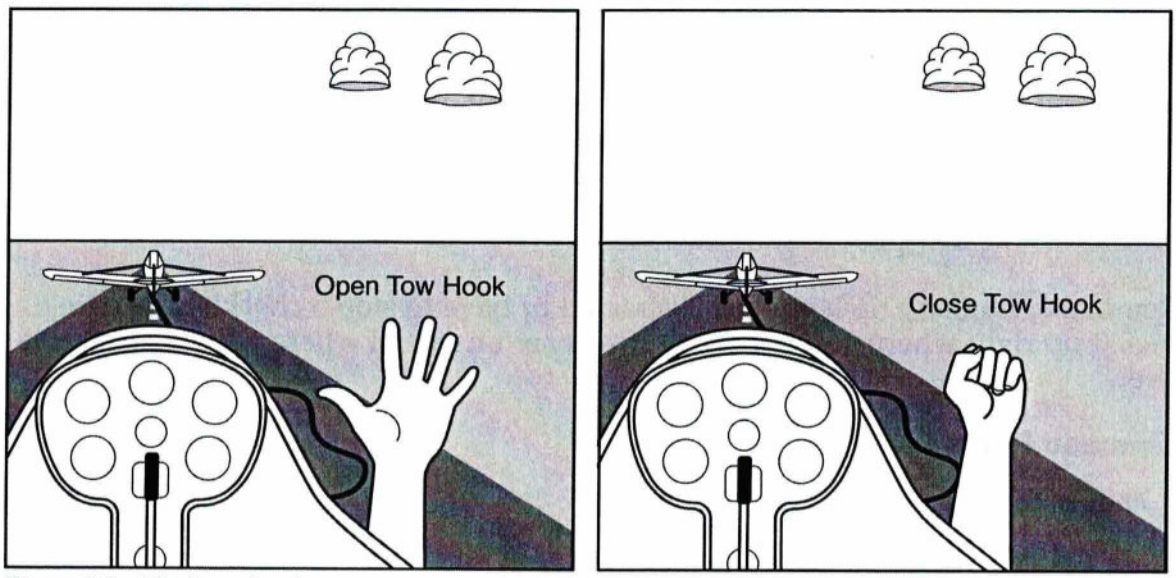


Figure 2.2 – Hookup signals

When getting ready for launch, the first signal you will see is the open signal. This is the line-person's signal to the glider pilot to pull on the towrope release handle to open the tow hook. The close signal is given when the tow ring is in position and the line-person wants the pilot to close the tow hook.

If you are using a Schweizer-style tow hook, close the release gently, so the line-person can adjust the tow hook position as necessary to make sure it is engaged in the release. On all other types of tow hooks, release the handle abruptly, to ensure that the hook closes completely.

After the towrope is attached to the glider, the line-person should tug on the rope to check the connection.

Take Up Slack

Once the towrope connection has been checked, the line-person will tell the tow pilot to take up the slack in the rope by moving to the wing tip and giving the take up slack signal.

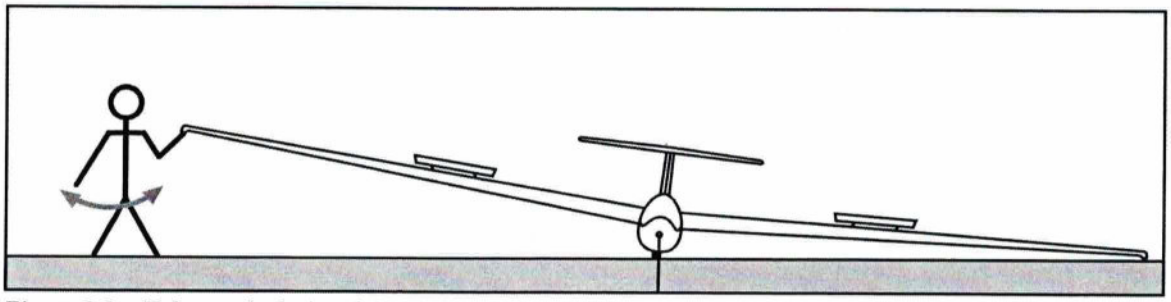


Figure 2.3 – Take up slack signal. Notice how the airbrakes are open, and the wing tip is on the ground.

While the tow pilot is taking up the slack, the wing runner should keep one of the glider's wing tips on the ground. This lets the tow pilot know that the glider is not yet ready to take off.

Ready for Takeoff

When the rope is tight, the wing runner will indicate to the tow pilot to wait for the glider pilot's ready signal by giving the hold signal. The wing runner should continue to hold one wing tip on the ground.

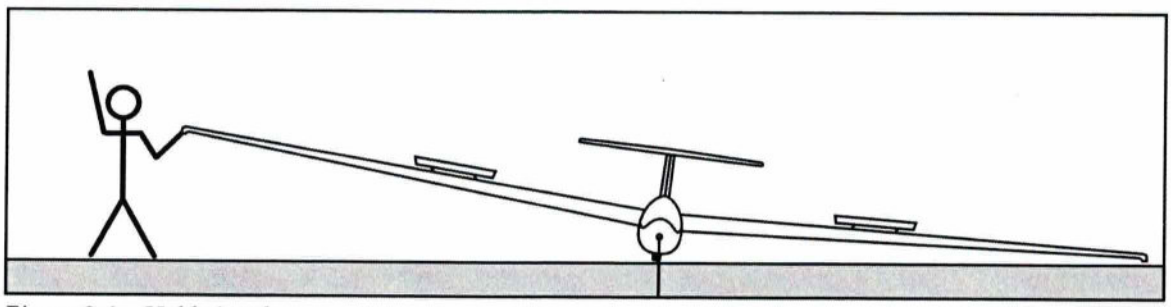


Figure 2.4 – Hold signal.

The glider pilot should give the thumbs-up signal once completely ready to take off. However, this is not the signal to begin the takeoff. This should be interpreted by the wing runner as the signal to level the wings, and do a final visual check for traffic, wind, etc., to make sure it is safe to launch.

If the wing runner does not see any reason why the glider should not launch, then the thumbs-up signal should be returned to the glider pilot.

Start Takeoff

When ready, the glider pilot should waggle the glider's rudder to indicate to the tow pilot to begin the takeoff. After seeing the rudder waggle, the wing runner should give the start takeoff signal to the tow pilot.

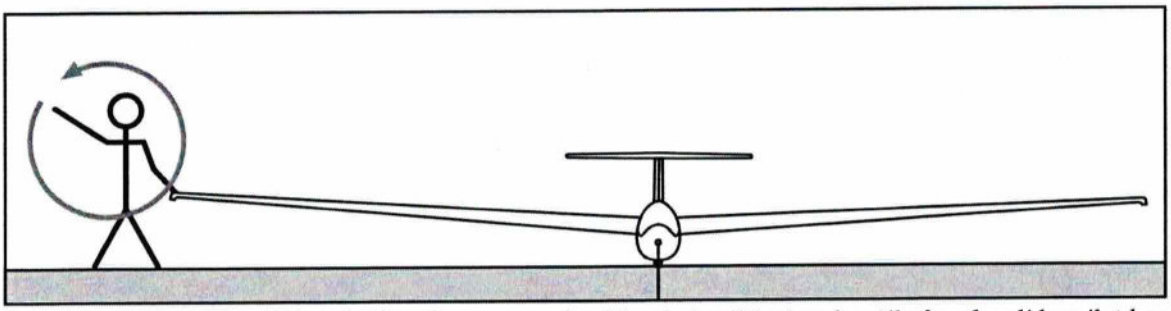


Figure 2.5 – Start takeoff signal. The wing runner should not give this signal until after the glider pilot has given the rudder waggle.

The tow pilot should not begin the takeoff until both the glider pilot and the wing runner have given their signals.

The wing runner should keep the wing tip from hitting the ground, but should not try to keep the wings absolutely level. By allowing the wings to tilt, the wing runner lets the glider pilot know that some corrective aileron is needed. This is better than having the wing slam down as soon as the wing runner has to let go.

The wing runner should not push or pull on the wing tip of the glider, since that would cause the glider to turn. When running another pilot's wing, you should hold the trailing edge of the wing tip between the thumb and fingers, so that the wing will fly out of your hand as the glider picks up speed.

Common Errors

- Glider pilot giving the thumbs-up before the airbrakes are closed and locked
- Wing runner holding the wings level before receiving a thumbs-up from the glider pilot
- Wing runner giving the takeoff signal before the glider pilot gives the rudder waggle
- Wing runner pushing or pulling on the wing tip during the takeoff

Completion Standard

This lesson is complete when you can explain and perform the launch procedures and signals.

2.3 Takeoff

Purpose

In this lesson, you will learn how to perform a normal takeoff in the glider.

Procedure

Until you become proficient at controlling the glider at altitude, your instructor will be performing the takeoffs. You will therefore have an opportunity to observe how your instructor controls the glider during takeoff.

Normally, takeoffs are performed into the wind if possible. The extra airspeed provided by the wind will make the controls become effective more quickly and allow the glider and tow plane to become airborne sooner.

The takeoff can be divided into three phases: 1) the initial ground roll, 2) the period when the glider is airborne but the tow plane is not, and 3) the climb-out when both glider and tow plane are airborne.

At the beginning of the takeoff roll, the controls will not be very effective. As the glider's airspeed increases, they will quickly become more effective, and care should be taken not to over-control the glider.

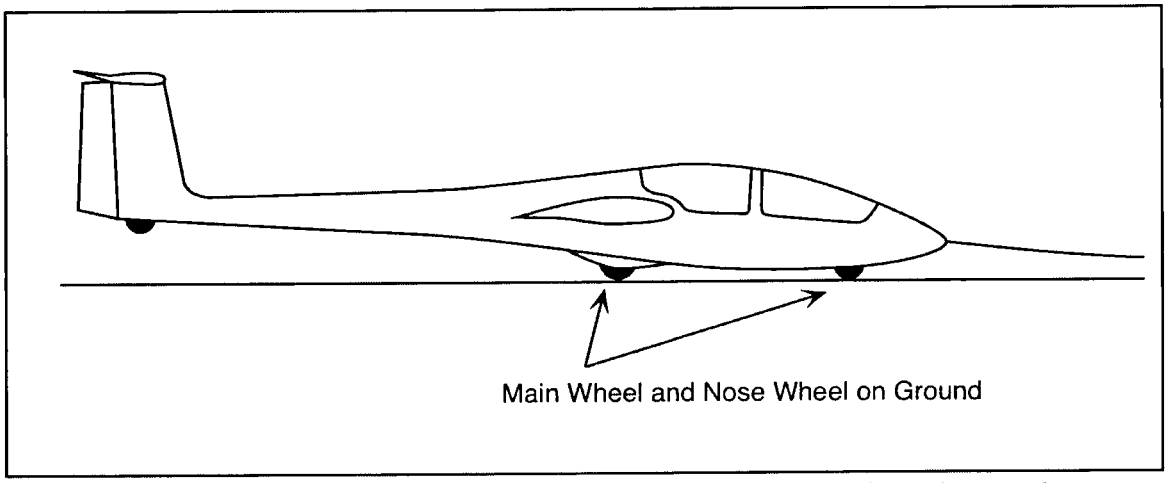


Figure 2.6 – During the initial ground roll, both the main and nose wheels will be on the ground.

During the initial ground roll, you should keep the nose of the glider pointed at the tow plane using the rudder, and keep the wings of the glider level using the ailerons. If the glider normally rests on its main wheel and nose wheel (or skid) while on the ground, the stick should be held aft of neutral, so that as the glider picks up speed, the nose wheel (or skid) will rise off the ground. If the glider normally rests on its main wheel and tail wheel, the stick should be held forward of neutral, so that as the glider picks up speed, the tail wheel will rise off the ground. You should then use the stick to keep the pitch attitude fixed, with the glider balanced on the main wheel, and both the nose wheel and the tail wheel off the ground.

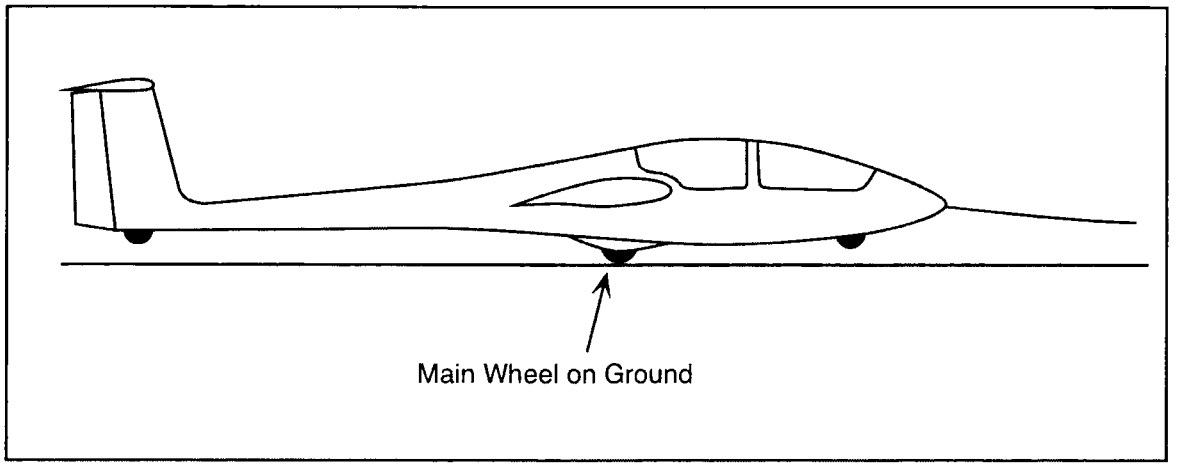


Figure 2.7 – Once you have sufficient airspeed for the controls to be effective, you should balance the glider on the main wheel.

As the glider gains airspeed, it will lift off the ground without any change in pitch attitude required. At this point, you should keep the glider at an altitude of about 5 to 10 feet above the ground, directly behind the tow plane. You want to be high enough so that if you hit a gust, you will not drop into the ground, but low enough that you do not pull up on the tail of the tow plane. You can use small bank angles to keep the glider behind the tow plane.

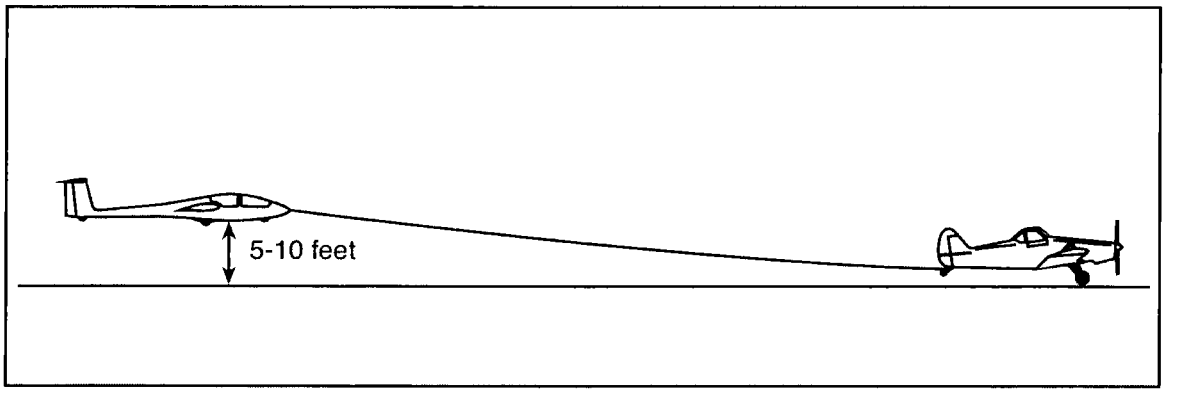


Figure 2.8 – After the glider becomes airborne, but before the tow plane takes off, the glider should maintain an altitude of about 5 to 10 feet above the ground.

As the tow plane takes off, keep the glider centered behind it using coordinated rudder and aileron, and keep at the same level as the tow plane by using the elevator. When you are at the same level as the tow plane, the horizon should intersect the tow plane. If the horizon is above the tow plane, you are too high. If the horizon is below the tow plane, you are too low.

If you don't start your takeoff roll from the centerline of the runway, keep the glider's nose pointed at the tow plane, and allow the glider to slowly drift toward the centerline. Don't try to steer the glider to the centerline, or you will most likely overshoot and end up on the other side of the runway.

NOTE: When towed by powerful tow planes, some gliders that have "belly" hooks have a tendency to hit the tail on the ground at the beginning of takeoff. To keep this from happening on these gliders, you may have to hold the stick full forward during the initial acceleration of the glider and tow plane. After just a second or two, you can then bring the stick back to a position aft of neutral to gently lift the nose wheel.

Things seem to happen very quickly during takeoff. With experience, you will be able to anticipate, recognize, and react to any situation that develops.

Common Errors

- Failure to balance the glider on the main wheel as soon as possible
- Failure to maintain a constant pitch attitude during the ground roll
- Failure to maintain the proper ground track
- Failure to keep the wings level
- Failure to maintain the proper altitude before the tow plane becomes airborne
- Pitch oscillations after liftoff due to over-controlling the elevator

Completion Standard

This lesson is complete when you can consistently perform the takeoff without instructor input, keeping the glider centered behind the tow plane, with the wings level and the glider balanced on the main wheel until it becomes airborne.

2.4 Crosswind Takeoff

Purpose

We prefer to take off directly into the wind. However, often, the wind is not blowing directly down the runway. In this lesson, you will learn to perform takeoffs in a crosswind.

Procedure

In order to fly a proper crosswind takeoff, you must first notice that there *is* a crosswind! Before takeoff, make sure to check the windsock or other indicators. If the crosswind is greater than the maximum crosswind allowed for your glider, you should not attempt to take off.

A crosswind takeoff begins with the placement of the glider on the runway. The glider should be positioned so that it is closer to the upwind side (the side the wind is coming from) of the runway and is pointing slightly to the downwind side. The glider will have a tendency to "weathervane" into the wind. Positioning the glider in this way gives you more time to gain speed, and thus control, before approaching the upwind edge of the runway.

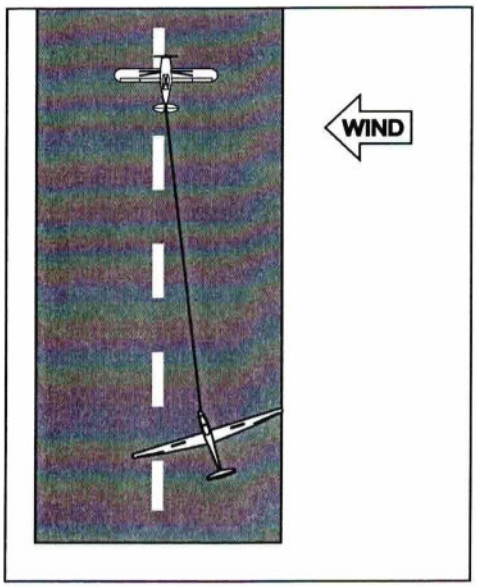


Figure 2.9 – Position the glider on the upwind side of the runway, with the nose pointing away from the wind.

At the beginning of the takeoff roll, you should hold full downwind rudder. As the airspeed increases, the rudder will become more effective, and the amount of downwind rudder needed to stay on the centerline will decrease. You should keep the upwind wing a bit low during the takeoff roll. If the wind gets under it and lifts it, it can be very difficult to lower it again.

You may find it helpful to keep the glider on its nose wheel (or tail wheel if a tail dragger) longer to help maintain a constant track during a crosswind takeoff.

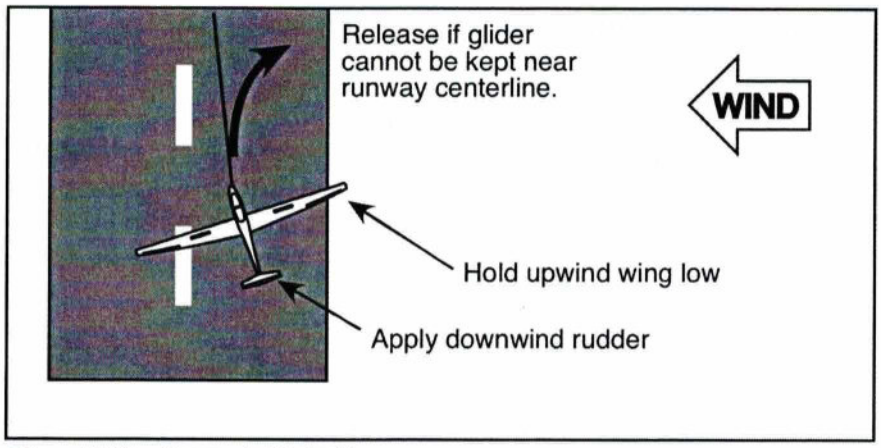


Figure 2.10 – Crosswind takeoff

As the glider lifts off, it may try to drift downwind, away from the centerline of the runway. This means that you didn't have the upwind wing low enough. Lower the wing a bit more to stop the drift. If the glider drifts upwind, you are holding the wing too low. Keep the nose of the glider pointing at the tow plane. You will be performing a side slip until the tow plane lifts off.

As the tow plane lifts off, it will turn into the wind to maintain position over the center of the runway. Once any obstacles to the side of the runway are cleared, you should recover from the side slip and assume normal tow position directly behind the tow plane.

If at any time during the takeoff you cannot keep the glider near the centerline of the runway, you should release the towrope and get the glider stopped. It is much better to abort a takeoff too early, when you can still try again, than too late, after you have damaged the glider!

Common Errors

- Failure to notice a crosswind
- Failure to position the glider on the runway correctly for the crosswind
- Continuing to hold full downwind rudder as the speed increases, causing the glider to veer to the downwind side of the runway
- Failure to maintain position over the centerline of the runway after the glider lifts off and while the tow plane is still on the ground

Completion Standards

This lesson is complete when you can recognize and compensate for a crosswind during takeoff.

2.5 Takeoff Without a Wing Runner

Purpose

Sometimes, no one will be available to run your wing during a takeoff. This may happen on a slow day at the gliderport, or when you are getting a retrieve at another airport after a cross-country flight. When this happens, you need to be able to perform a takeoff that starts with one wing tip dragging on the ground.

Procedure

When you start a takeoff without a wing runner, one wing tip will start out in contact with the ground. This tip will have more drag due to friction with the ground. As you try to lift this tip using the aileron, the resulting induced drag will add to this drag. This will cause the glider to tend to yaw in the direction of the lowered wing tip. You must anticipate this effect when positioning the glider on the runway, especially if the runway is narrow. How much drag there is on the lowered tip, and how much it will cause the glider to yaw, depends on several factors, including whether or not the tip has a wheel, what kind of surface the tip is dragging on, and whether the glider has a nose or CG tow hook. A tip wheel on pavement will have little drag, while a tip skid on rough dirt will have a significant amount of drag. A nose hook tends to restrict the glider from yawing.

Since the glider will veer in the direction of the lowered wing, you should position it so that the lowered wing has more clearance from obstacles. You might also want to point the glider's nose slightly "away" from the lowered wing, expecting that the drag from the lowered wing will straighten the glider out at the beginning of the takeoff roll.

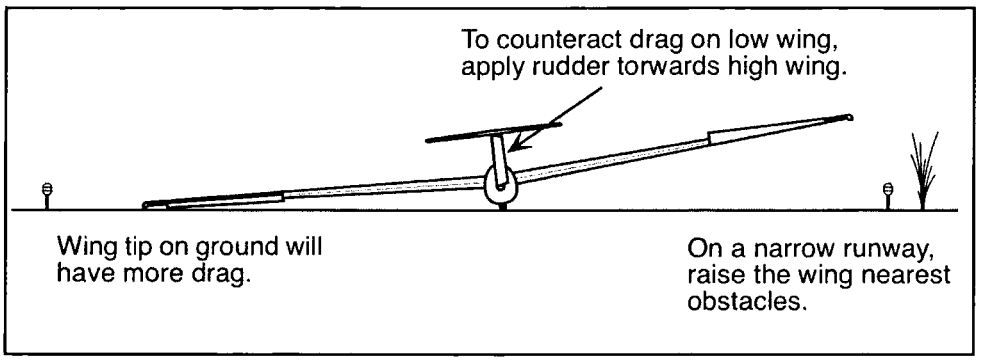


Figure 2.11 – Positioning the glider for a takeoff without a wing runner

If there is no wind, or the wind is straight down the runway, the takeoff procedure is relatively straightforward. Just use the aileron to lift the lowered wing and enough rudder to overcome the adverse yaw and the friction of the tip dragging on the ground. Remember to neutralize the ailerons as soon as the wings are level to keep the other wing tip from hitting the ground.

In a crosswind, things are more complicated. You need to decide whether the upwind or downwind wing tip will start out on the ground. Whichever you

choose, remember that if the takeoff does not proceed as desired, you can always pull the release and try it again with the other wing tip down.

If you are taking off from a wide runway with no obstacles (e.g., runway lights, weeds, etc.), you will probably want to start with the upwind wing low. The advantage of this is that as soon as you have some forward speed, you should be able to pick up the lowered wing. However, in this configuration, both the wind and the friction from the lowered wing will turn the glider into the wind.

If the runway is narrow or if there are obstacles on the sides, you might want to take off with the upwind wing high. This ensures that the wing won't come down until you have the airspeed to control it. In addition, with this method, the drag on the down wing helps offset the tendency of the glider to turn into the wind. However, since it is more difficult to level the wings with the upwind wing held high, there is a chance that you will not gain enough roll control before you start to veer to the side of the runway.

Remember that if one method does not work, release and try it a different way. If the other way doesn't work, you will have to wait for the wind to die down or change direction, or find a wing runner.

Common Errors

- Failure to position the glider correctly on the runway
- Not releasing soon enough if things start to go wrong
- Not using full aileron deflection to lift the low wing

Completion Standard

This lesson is complete when you can consistently perform a takeoff without a wing runner.

2.6 Downwind Takeoff

Purpose

At times it is preferable to take off with, instead of into, the wind. This might be the case if there is a definite slope to the runway and it is desirable to take off downhill, or if there are obstacles near the upwind end of the runway. In this lesson, you will learn to perform a downwind takeoff.

Procedure

A downwind takeoff differs from a regular takeoff in that the controls do not become responsive until the ground speed is noticeably higher. If the glider starts to veer to the side of the runway, the pilot must immediately pull the release and get the glider stopped.

Before the takeoff, you should be very careful to align the glider exactly in the desired direction on the runway. You will not be able to alter the direction until the rudder becomes effective, which will occur much later during the takeoff roll.

Any time the nose wheel (or skid) is on the ground the glider will be less stable in yaw. It is therefore all the more important to get the nose wheel off the ground early during a downwind takeoff.

During a downwind takeoff, the ground speed will be much higher before the glider becomes airborne. You should resist the temptation to force the glider into the air by lifting the nose. Fly the same pitch attitude you would fly during a regular takeoff, and let the glider lift off when it is ready.

As a result of the higher ground speed, both the glider and the tow plane will need more runway to become airborne, and will climb out shallower, making it more difficult to clear any obstacles. These factors should be taken into account when planning a downwind takeoff.

On a glider with a nose hook, the towrope will assist in keeping the glider tracking straight. If the nose starts to yaw, the tension on the towrope will tend to force the glider to point back at the tow plane. However, on a glider with a center of gravity tow hook, this restoring force will not be present, making a downwind takeoff that much more challenging.

Common Errors

- Failure to notice the wind direction
- Failure to position the glider precisely on the runway
- Forcing the glider into the air at too low of an airspeed
- Not releasing immediately if things start to go wrong

Completion Standard

This lesson is complete when you can explain the factors involved in a downwind takeoff and can consistently perform downwind takeoffs without the aid of the instructor.

2.7 High Density Altitude Takeoff

Purpose

If you are learning to fly at an airport near sea level, you will probably be surprised the first time you perform a takeoff at a runway located in the mountains. This will be especially true if the day is hot. The low air density will reduce the amount of thrust that the tow plane can produce, and the glider and tow plane will require higher true airspeeds before they can produce enough lift to take off. While you may not have the opportunity to perform a high altitude takeoff during your training, in this lesson you will learn the factors involved with these conditions.

Procedure

The first thing you will notice during a high altitude takeoff is the slower rate of acceleration. At high altitudes, the air is less dense, so there is less oxygen available to the tow plane's engine. This results in less power and therefore less acceleration. Since it will take more time to reach the airspeed where the controls are effective, there is more of a chance for a gust or a crosswind to upset the glider. If at any time you do not feel that you are able to keep the glider under control, you should pull the release and get the glider stopped.

During a high altitude takeoff, the ground speed will be much higher before the glider becomes airborne. You should resist the temptation to force the glider into the air by lifting the nose. Fly the same pitch attitude you would fly during a normal takeoff, and let the glider lift off when it is ready.

Because of the higher ground speed, both the glider and the tow plane will need more runway to become airborne. The climb rate will also be much lower, making it harder to clear obstacles.

You will find that a high altitude takeoff is very similar to a downwind take off.

Common Errors

- Not taking into account the extra runway needed for a high altitude takeoff
- Forcing the glider into the air at too low of an airspeed
- Not releasing immediately if things start to go wrong

Completion Standard

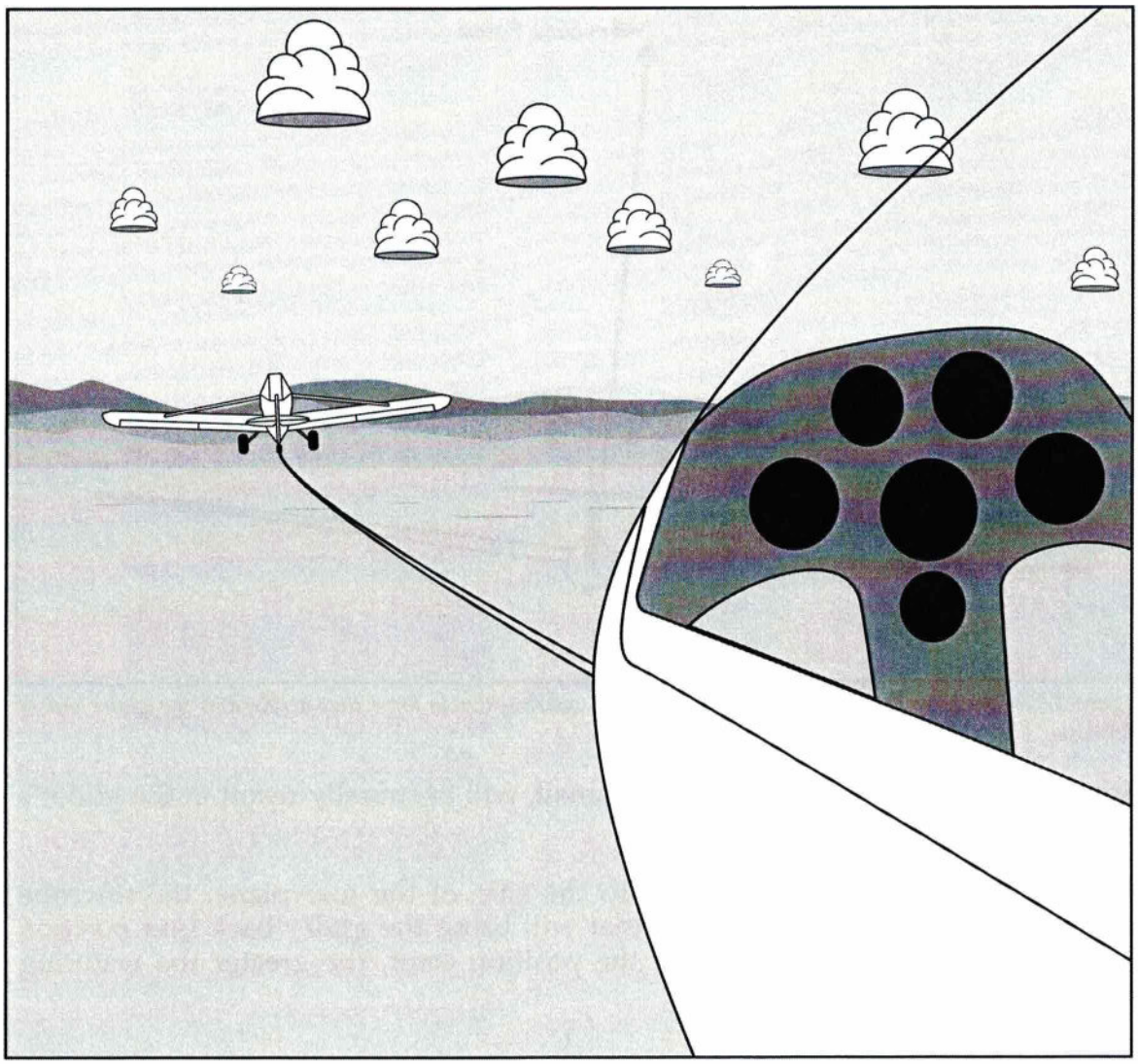
This lesson is complete when you understand and can explain how high altitude affects the glider and tow plane on takeoff.

CHAPTER 3: AEROTOW

Before we can soar, we have to be towed up. Aerotowing means towing the glider behind an airplane. The vast majority of gliderports in the United States use aerotowing as the method of getting a glider into the air.

A towrope approximately 200 feet long connects the glider to the tow plane. Both the tow plane and the glider have a mechanism for releasing the rope. However, in normal operations, the glider pilot releases the rope and terminates the tow.

In this chapter, you will learn how to fly the glider on tow, how to communicate with the tow pilot through various signals, and how to safely deal with slack in the rope, both in straight and in turning flight.



3.1 Introduction to Flying the Aerotow

Purpose

In this lesson, you will learn to use the stick (ailerons and elevator) to maintain position behind the tow plane, while your instructor controls the rudder.

Procedure

The Physics of the Aerotow

Before you learn about flying the aerotow, it is helpful to know some of the basic physics involved. First, you need to realize that unless the wings of the glider are kept parallel to the wings of the tow plane, a side force acting on the glider will move it out of position.

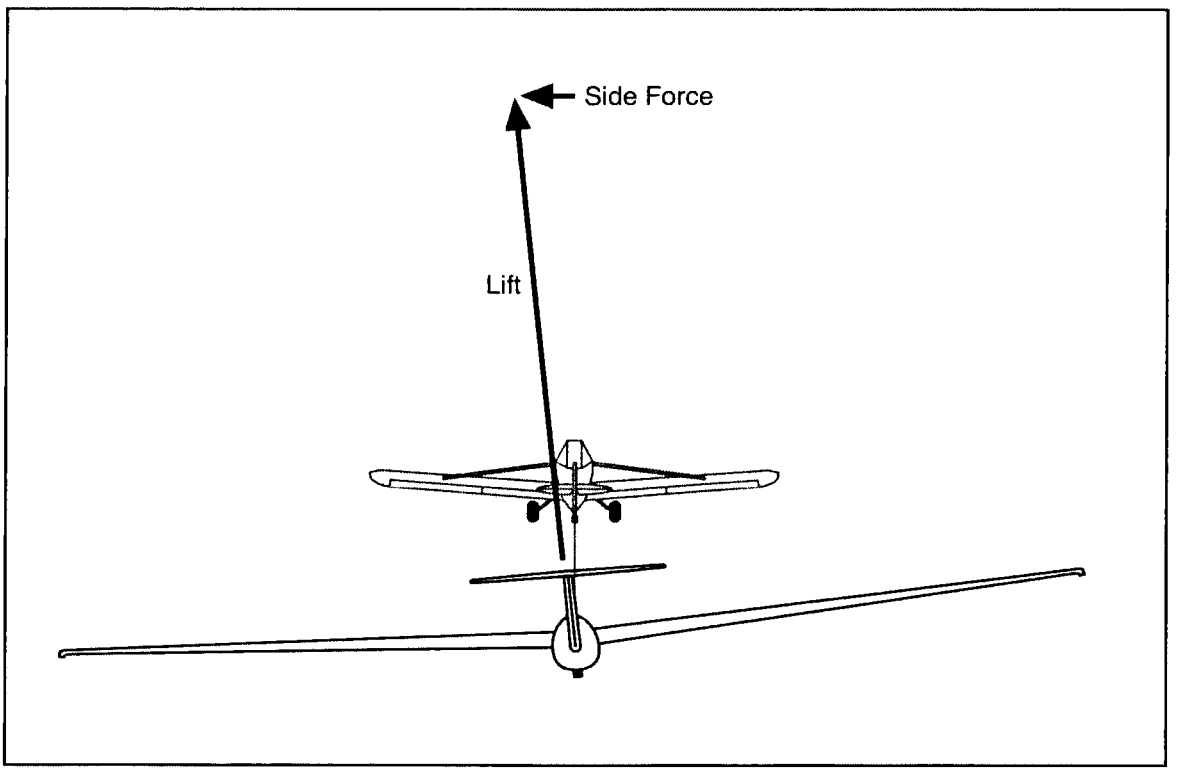


Figure 3.1 – Banking the glider tilts the lift vector, causing a side force that accelerates the glider out of position.

Any bank angle error, no matter how small, will eventually result in the glider's drifting out of position.

When the glider is out of position to the side of the tow plane, the towrope actually provides a restoring force that will bring the glider back into position behind the tow plane. The greater the position error, the greater the restoring force, as shown in Figure 3.2.

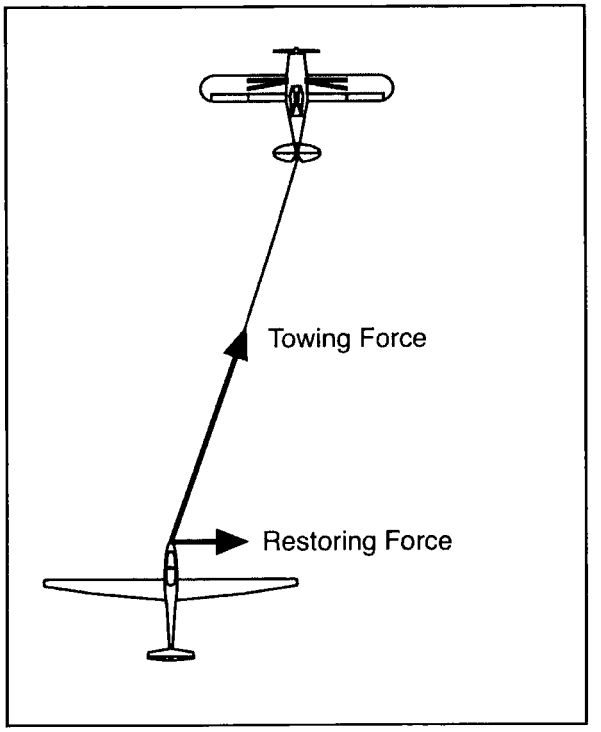


Figure 3.2 – Restoring force resulting from position error on tow

If the wings of the glider are held parallel to the wings of the tow plane, the restoring force generated by the towrope will bring the glider back into position. If no further corrections are made, momentum will cause the glider to overshoot to the opposite side. As the glider regains its position behind the tow plane, it is therefore necessary to apply a small, momentary bank angle to halt the glider's sideways movement.

Flying the Aerotow

Your instructor will not have you attempt to fly the aerotow until you have mastered the basic flight controls and can hold a pitch attitude and heading while in free flight.

Flying the aerotow is a form of formation flying. As such, it requires keen observation and precise flying. Don't be discouraged if your first several attempts to fly the aerotow result in your instructor saying "I have it" after only a few seconds.

After climbing to a safe altitude, your instructor will tell you to take the stick. The instructor will continue to control the rudder. The goal when flying aerotow is to maintain position directly behind and at the same level as the tow plane. You know you are on the same level as the tow plane when it is on the horizon, and you know you are directly behind the tow plane when the tow plane's rudder appears centered on its fuselage. If mountains or haze obscure the horizon, you will have to rely on visual cues from the tow plane to determine if you are in the proper vertical position with respect to the tow plane. Notice in

Figure 3.3 the horizontal stabilizer is lined up with the wing of the tow plane (a Pawnee in this case). If you were too high, the stabilizer would appear below the wing, and if you were too low, the stabilizer would appear above the wing. You will have to determine the visual cues for the type of tow plane(s) used at your gliderport.

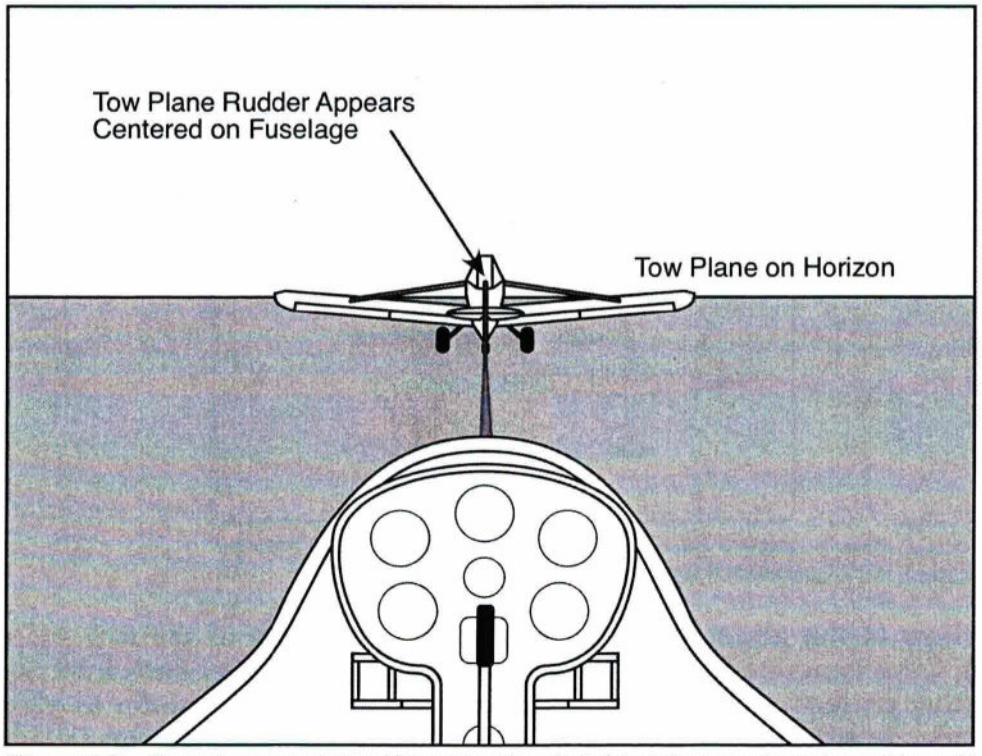


Figure 3.3 – Correct tow position. If you are directly behind the tow plane, its rudder will appear centered on the fuselage. If you are level with the tow plane, the horizon will intersect it.

The key to staying in position on tow is to recognize when you are just starting to move out of position and to immediately take the proper corrective action. Look for relative motion between the tow plane and the glider. As soon as you notice the tow plane drifting, apply very small control corrections. You should first try to stop the relative motion between the glider and the tow plane, and then slowly move the glider back into position.

If you find yourself off to one side of the tow plane, it is usually only necessary to match the tow plane's bank angle, or to briefly establish a bank angle towards the tow plane. Once the glider starts to move back in the desired direction, you should remove the bank angle and let momentum carry the glider back into position. If you hold the bank angle too long, the glider will accelerate and probably overshoot to the other side of the tow plane.

Use very small bank angles when on tow. Large bank angles will cause the glider to accelerate rapidly to the side, making it difficult to control and perhaps inducing slack in the line.

If a gust starts to cause the glider to pitch or roll, you must use the controls to keep the glider at the desired pitch and bank angles. If you allow the bank angle to change, you will eventually end up to the side of the tow plane. If you allow the pitch angle to change, you will end up above or below the tow plane.

Common Errors

- Failing to notice when the glider is getting out of position
- Using too much bank angle/control movement
- Not removing bank angle correction early enough
- Failure to maintain a constant pitch and bank angle when in the proper position on tow

Completion Standard

This lesson is complete when you can consistently maintain position on tow using the stick, while the instructor controls the rudder.

3.2 Flying the Aerotow with Stick and Rudder

Purpose

In this lesson, you will learn to use the rudder to counteract adverse yaw while on tow.

Procedure

Once you are proficient at flying the aerotow with the stick, your instructor will give you responsibility for the rudder also. Adverse yaw is more noticeable on tow, simply because the tow plane provides a visual reference.

Once you reach a safe altitude, your instructor will give you control of both the stick and rudder. Concentrate on keeping the wings of the glider parallel to the wings of the tow plane, and the nose of the glider pointed at the tow plane.

Just as when flying the tow with stick alone, remember that when you get out of position, first stabilize the glider, and then slowly move back into position. Remember that as long as you keep the nose of the glider pointed at the tow plane, and the wings of the glider parallel to the wings of the tow plane, it will eventually drift back into position.

Common Errors

- Using too little or too much rudder
- Failure to keep the glider coordinated during the tow
- Using too much bank angle

Completion Standard

This lesson is complete when you can maintain position on tow using both the stick and rudder.

3.3 Release from Tow

Purpose

In this lesson, you will learn the proper procedures for releasing from the tow plane.

Procedure

It is the glider pilot, not the tow pilot, who determines how high to climb before releasing from tow. (Only in an emergency would the tow pilot release the rope.) Once you have reached your desired altitude, you should perform the following actions.

Stabilize

Before you release, you should make sure the glider is in a stable position behind the tow plane.

If you are climbing while you release, there can be considerable tension on the towrope, so that when you release, it can spring forward and tie itself into a knot. This will prevent the tow pilot from reeling in the rope if the tow plane is equipped with a winch, or it can cause wear on the rope as the knot drags along the ground.

If you are too low or if there is slack in the rope, it can sweep back over the glider, possibly damaging the glider or even becoming snagged on it.

Check for Traffic

Once off tow, the glider pilot turns to the right, and the tow pilot turns to the left. It is therefore critical that you check both directions for traffic before initiating the release.

Release

Once you have stabilized the glider and checked for traffic, you can pull the release. You should verify that the rope has indeed released before altering your course.

Turn Right

After you have verified that the towrope has been released, you should start a level (non-climbing) turn to the right. Keep your airspeed constant during the turn. It is important to get in the habit of performing a constant-speed turn after release. This way, if you ever have a premature release from tow at a low altitude, you will not have a tendency to raise the nose of the glider, possibly causing a stall.

Set the Airspeed

Once you have completed a 90° turn to the right, you can adjust the pitch for your desired airspeed and trim the glider. Usually, this will mean slowing down from your tow speed.

Locate the Airport

It is not unusual for students to be so focused on flying the aerotow that they lose orientation with the airport. If you have lost the airport during the tow, make sure that you locate it soon after you release.

Common Errors

- Failure to stabilize the glider behind the tow plane before releasing
- Failure to check for traffic before releasing
- Failure to verify that the rope has released before turning
- Letting the nose pitch up after release

Completion Standard

This lesson is complete when you consistently perform the proper tow release sequence.

3.4 "Soft" Release (Optional)

Purpose

To reduce the wear and tear on the glider's tow hook and to decrease the chance of getting knots in the towrope, some glider operations use a "soft" release. A soft release is performed by putting a small amount of slack in the towrope before releasing. In this lesson, you will learn how to perform a soft release.

Procedure

Your instructor will first demonstrate what a soft release looks and feels like. The glider is maneuvered slightly above and to the left of the tow plane, and then a moderately rapid descent is made back to a position level with, and just to the left of the tow plane.

You will notice that the glider accelerates as it climbs so that you don't have to use much forward pressure on the stick to get slack to develop. You do have to wait a few seconds after starting the descent for the slack to show up.

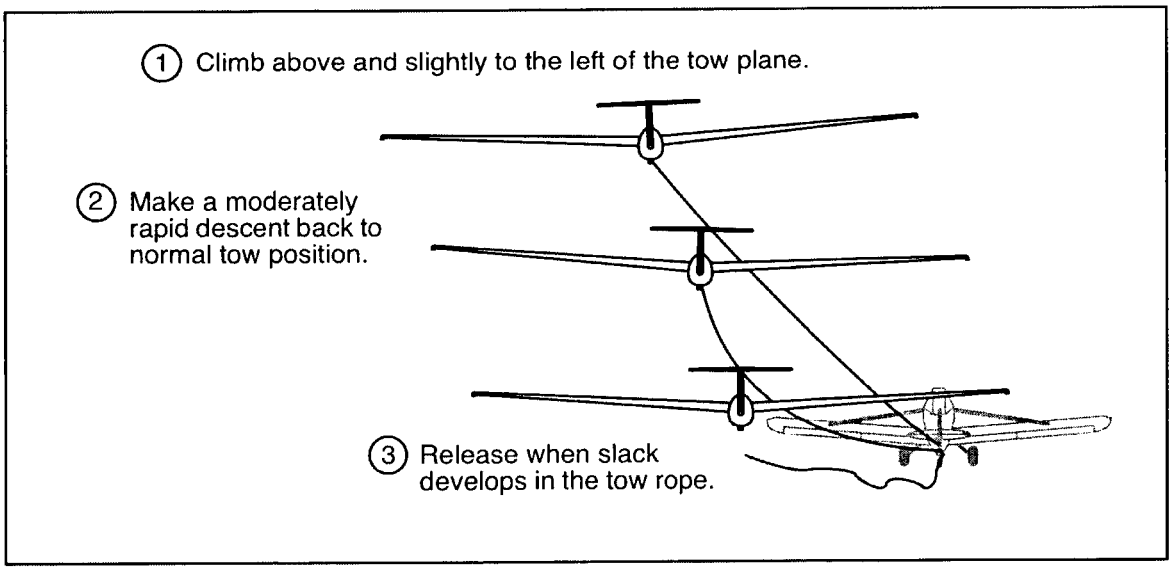


Figure 3.4 – "Soft" release

Next, it will be your turn. After stabilizing behind the tow plane and clearing the area, climb gently and move slightly to the left so that you can keep an eye on the towrope. You do not need to climb very high with respect to the tow plane. If you climb too high, you can create more slack than necessary.

Next, lower the nose, so that you are slightly to the left of, and level with the tow plane without descending below it. If you approach this position quickly enough, slack will develop in the rope. Pull the release handle, and watch to confirm that the rope has released. When the rope has released, turn to the right as for a normal release.

Do not descend below the tow plane during the soft release. If the towrope does not release, you do not want to pull the tow plane's tail down or have the towrope break and blow into the glider.

It is important that you don't start your right turn until AFTER you have confirmed that the rope has dropped away. If for some reason the rope does not release, you should hold the tow release open and remain behind the tow plane until the rope comes tight.

Common Errors

- Failure to clear the area before releasing
- Failure to stay off to the left side of the tow plane to maintain visual contact with the rope
- Climbing too rapidly or too high
- Descending too rapidly, causing excess slack
- Starting your turn before confirming the release of the towrope

Completion Standard

This lesson is complete when you can consistently perform a soft release.

3.5 Shifting Through the Wake

Purpose

All aircraft produce a wake as a consequence of producing lift. In some circumstances, it is preferable to be below the wake (in "low tow") rather than the normal "high tow" position. This is often the case during an aero-retrieve tow (see Section 15.8 of the *Glider Pilot's Handbook of Aeronautical Knowledge*).

In this lesson, you will learn the boundaries of the tow plane wake, the effect the wake has on the glider, and how to shift through the wake between the normal and low tow positions.

Procedure

The wake of the tow plane is a combination of the disturbances caused by the wing deflecting the air downward and the propeller pushing the air backward. The wake descends as it moves further behind the tow plane. Even in level flight, the wake will be below the tow plane.

Your instructor will demonstrate the position of the wake by slowly descending into and through the wake. You will notice that the boundary of the wake is quite distinct: there is no doubt when you enter the wake or when you leave it. Your instructor will point out visual references to the tow plane that mark the lower boundary of the wake. The instructor will then slowly transition back to normal tow position.

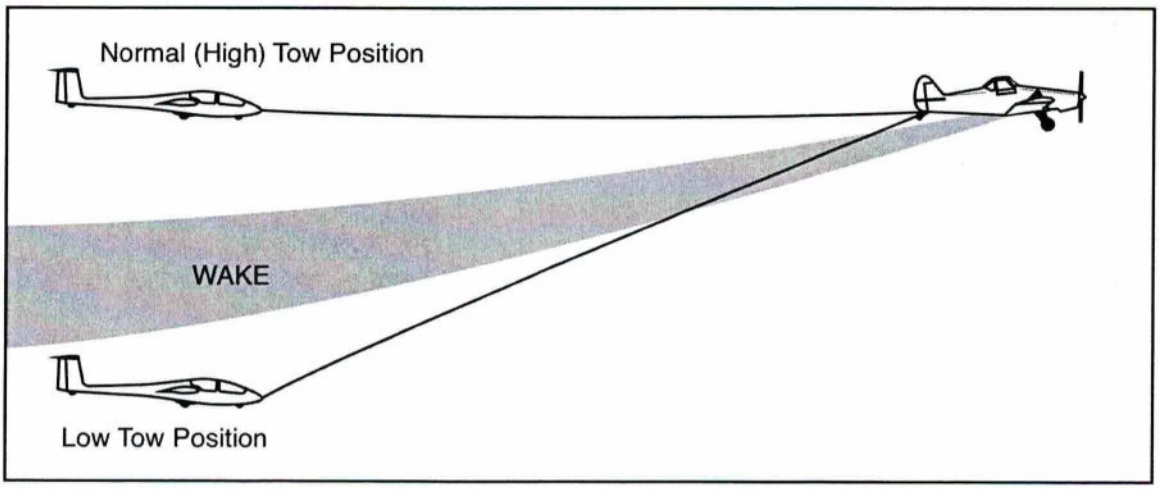


Figure 3.5 – Shifting through the wake

Next, you will take the controls and descend through the wake. Your descent should be slow, or you risk starting to overtake the tow plane and getting slack in the rope. The descent should be steady so that you don't spend more time than necessary in the turbulent wake, which tends to buffet and roll the glider, making it more difficult to control.

Use the visual references that your instructor pointed out to keep from descending too low.

You will then return to normal tow position. You should do this slowly as well, so that you don't put too much strain on the towrope or tow plane.

Common Errors

- Descending too abruptly when moving to low tow position
- Stopping the descent while in the middle of the wake
- Climbing back through the wake too abruptly
- Failure to keep the wings level and the glider centered behind the tow plane.

Completion Standard

This lesson is complete when you can transition smoothly between high and low tow positions.

3.6 Steering Turns

Purpose

While on tow, you may want to go in a different direction than the tow plane is taking you. Perhaps you think the lift will be better somewhere else, or you may simply want to stay upwind of the airport. In this lesson, you will learn how to perform "steering turns" in order to let the tow pilot know where you would like to go.

Procedure

Steering Turn Signals

To indicate to the tow pilot that you want to turn, you move the glider out to the side of the tow plane. If you want to turn to the right, you move to the left of the tow plane. If you want to turn to the left, you move to the right. To continue the turn, maintain this relative position with the tow plane.

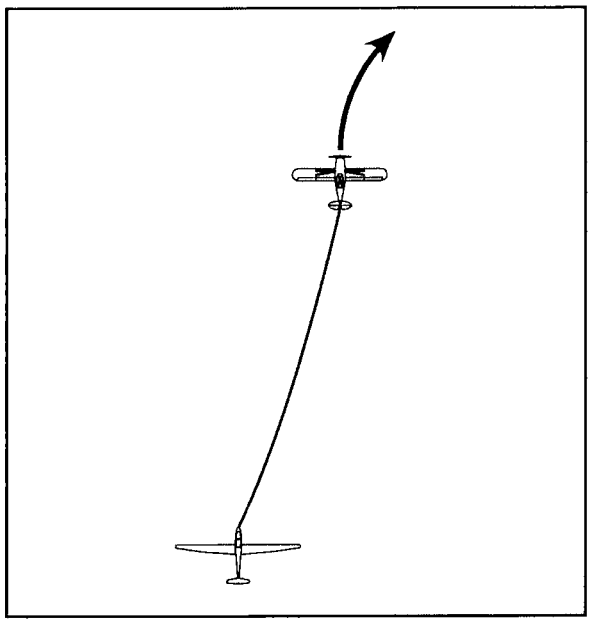


Figure 3.6 – Steering turn. Move to the left to signal a turn to the right.

To signal the tow pilot to end the turn, resume your position directly behind the tow plane.

Performing a Steering Turn

Just as with any other turn, before performing a steering turn, you should check both directions for traffic. You should then move to one side by establishing a shallow bank angle with the ailerons. Since the towrope tries to pull you back in behind the tow plane, you may have to increase the bank angle as you move further to the side. If your glider has a nose hook, you may also have to apply some outside rudder, since the towrope will try to pull the nose to the inside of the turn.

Your instructor will tell you how far to move to the side and will give you visual references on the tow plane to let you know when you are in the proper position.

When you have stabilized in the correct steering turn position, the tow pilot should start a gentle turn by banking the tow plane's wings. You should wait about two seconds after the tow plane starts to turn before you start your turn. If you start your turn too soon, you will turn inside of the tow plane, making the tow pilot think you want to stop the turn.

Since you are to the outside of the tow plane during the turn, you will be flying a slightly larger diameter circle, and will therefore be going slightly faster. Because of the increased airspeed, the glider will try to climb. You will probably have to hold a little forward pressure on the stick to keep the glider from rising above the tow plane.

If the glider starts to drift back behind the tow plane, you should decrease your bank angle. If the glider starts to drift to the outside of the turn, you should increase your bank angle. If you get too far outside of the turn, your airspeed will start to increase dramatically. In Lesson 3.10, you will learn how to recover from this condition, but at this stage, your instructor will probably take control if you find yourself fast, high, and to the outside of the turn.

As you approach your desired heading, slightly increase your bank angle to move the glider back behind the tow plane, indicating to the tow pilot to stop turning. As you move behind the tow plane, your airspeed will decrease. Make sure the glider does not descend. You should then level your wings as the tow pilot levels his, and resume normal tow position.

Common Errors

- Moving too far to the outside of the tow plane
- Allowing the glider to climb when starting the turn because of the increased airspeed
- Not maintaining position during the turn
- Allowing the glider to descend when moving back behind the tow plane because of the decrease in airspeed

Completion Standard

This lesson is complete when you can turn the tow plane to a desired heading while maintaining the correct vertical and horizontal position relative to the tow plane.

3.7 Aerotow Signals

Purpose

If available, the radio is often the best method to communicate with the tow pilot. However, in case a radio is not available or the airport frequency is too crowded, you need to be able to communicate with the tow pilot using signals. In this lesson, you will learn to perform and recognize the standard aerotow signals.

Procedure

Before your lesson, you should memorize the different aerotow signals. During your lesson, your instructor will demonstrate the signals and then have you practice them.

Increase Airspeed

The tow pilot may inadvertently tow you at a speed that is too slow for you to maintain control of the glider. For example, this could happen when you are carrying water ballast. To get the tow pilot to speed up, rock the wings of the glider while maintaining position behind the tow plane. Adverse yaw can be a real pain as you perform this signal! You will need to use the rudder to prevent the nose of the glider from swinging side to side.

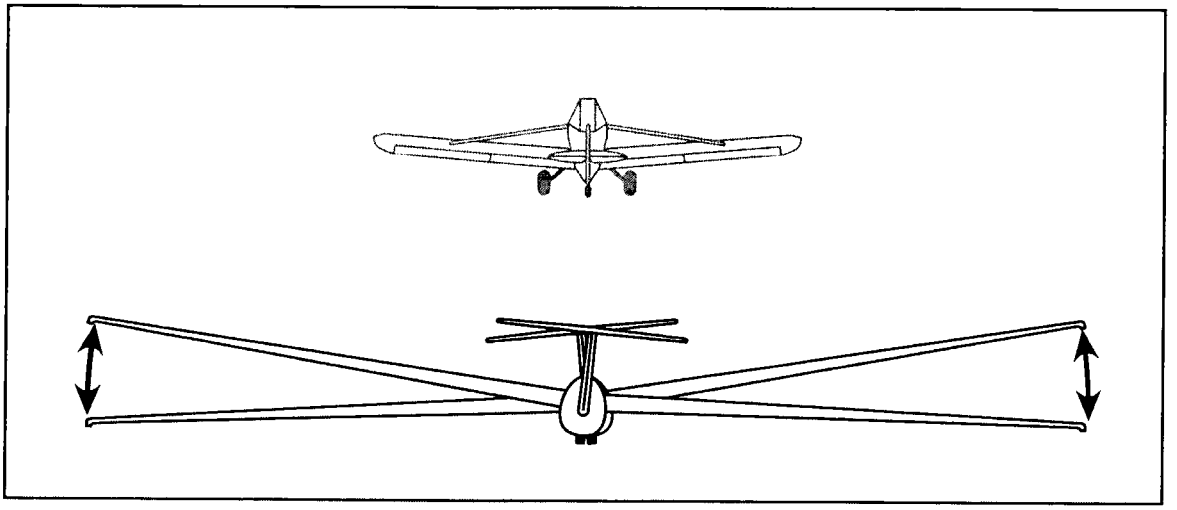


Figure 3.7 – Increase airspeed signal. Gently rock the glider's wings to tell the tow pilot to speed up.

Remember to be gentle on the controls if you are at a low airspeed to avoid a stall. If you are going too slowly to comfortably rock your wings, you should consider releasing.

Decrease Airspeed

All gliders have a maximum aerotow speed. If the tow plane is starting to approach that speed, you should signal to the tow pilot to slow down. To give the slow down signal, yaw the glider back and forth using the rudder. The glider will want to bank because of the coupling between yaw and roll caused by the

wing dihedral. Keep the wings level using the ailerons, or the tow pilot might think you want to speed up!

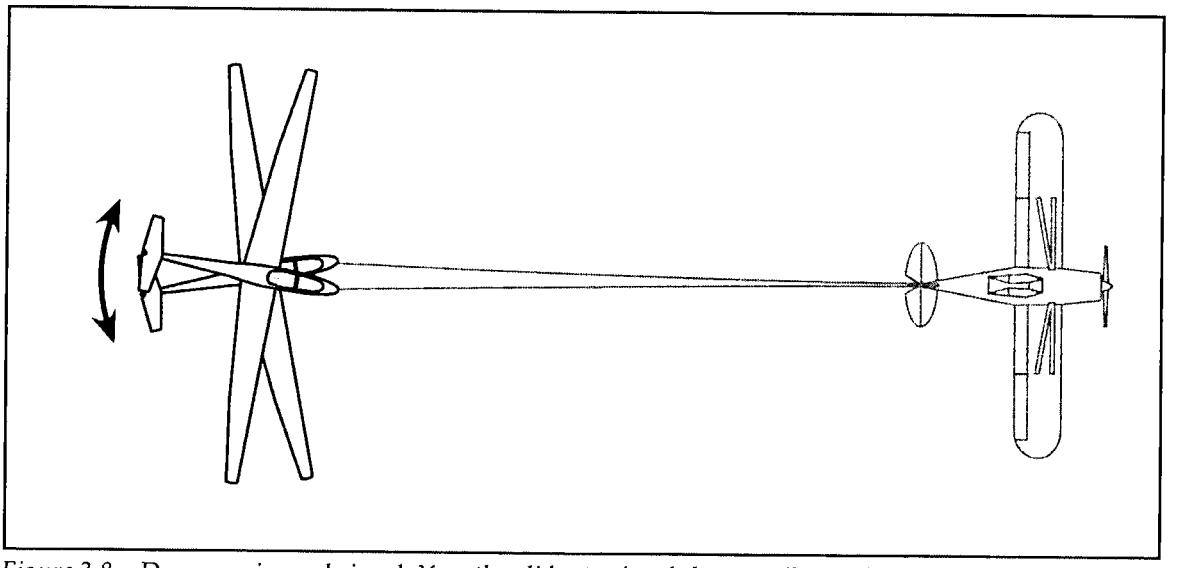


Figure 3.8 – Decrease airspeed signal. Yaw the glider to signal the tow pilot to slow down.

Remember that the higher-drag maneuver, yawing back and forth, is the signal to slow down, while the lower-drag maneuver, rocking the wings, is the signal to speed up.

Glider Release Failure

If the release doesn't work on the first try, you can have the instructor/passenger pull their release handle, or try yawing the glider or putting slack in the line before pulling the release again. The following signal can be used if after repeated tries, you cannot get the towrope to release from the glider.

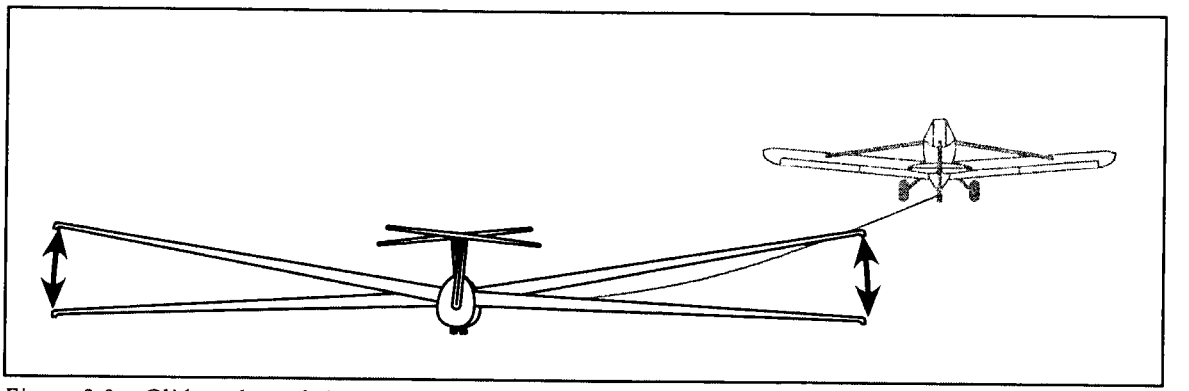


Figure 3.9 – Glider release failure signal. Move to the left of the tow plane and rock the wings of the glider.

If the glider release does not work, you should move out to the left side of the tow plane and rock the wings of the glider. Make sure you move to the left instead of the right when performing this signal so that the tow pilot doesn't think you are turning to the right after having released.

After the tow pilot sees this signal, you will either see the tow plane release the towrope (the tow pilot may first take you over an area where the falling rope will not endanger anyone on the ground), or you will see the tow plane yawing back and forth, indicating that the tow plane release has also failed. In the unlikely event that this happens you have two options. You can either land on tow, or intentionally break the rope. The execution of these options is described in Chapter 8: Emergency Procedures.

If the tow pilot ends up releasing the rope, you should allow plenty of clearance over any obstacle when on final. You may have 200 feet of rope dangling from your nose that could get tangled in trees, power lines, or fences.

Release Immediately

The tow pilot may want you to release if there is a problem with the tow plane, such as a loss of power or an engine fire. In this situation, the tow pilot will rock the wings of the tow plane, giving the "rock off" signal. If you see this signal, you *must* release immediately.

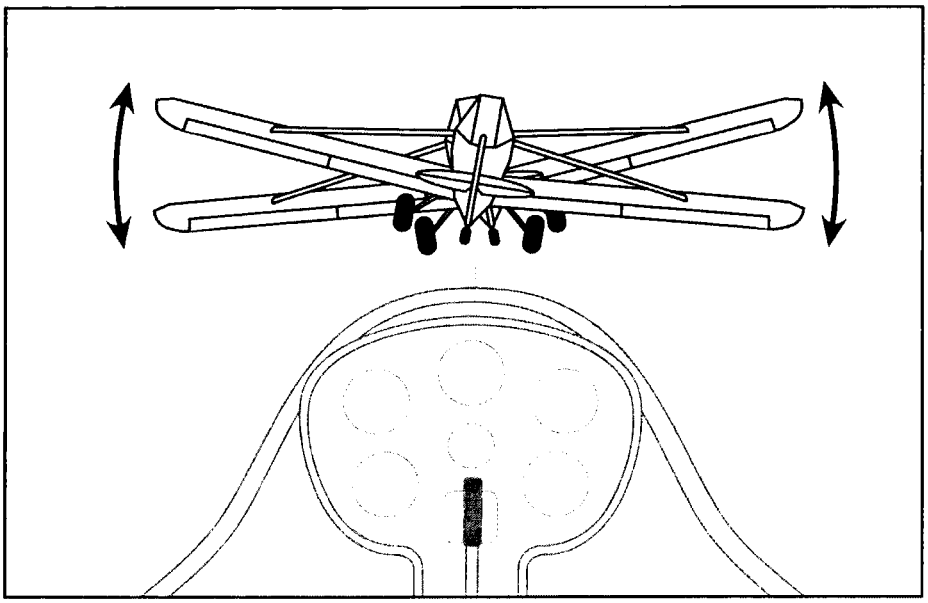


Figure 3.10 – Release immediately signal. If the tow plane rocks its wings, you must release the towrope immediately.

In gusty conditions, you may sometimes see the tow plane lift a wing, but this will look different from a rock off. During a rock off, the tow pilot will quickly and deliberately rock the wings.

Check Airbrakes

If while on tow you see the tow plane's rudder waggle, the tow pilot is telling you that there is something wrong with the glider. Usually this means your airbrakes have come open and you should close them.

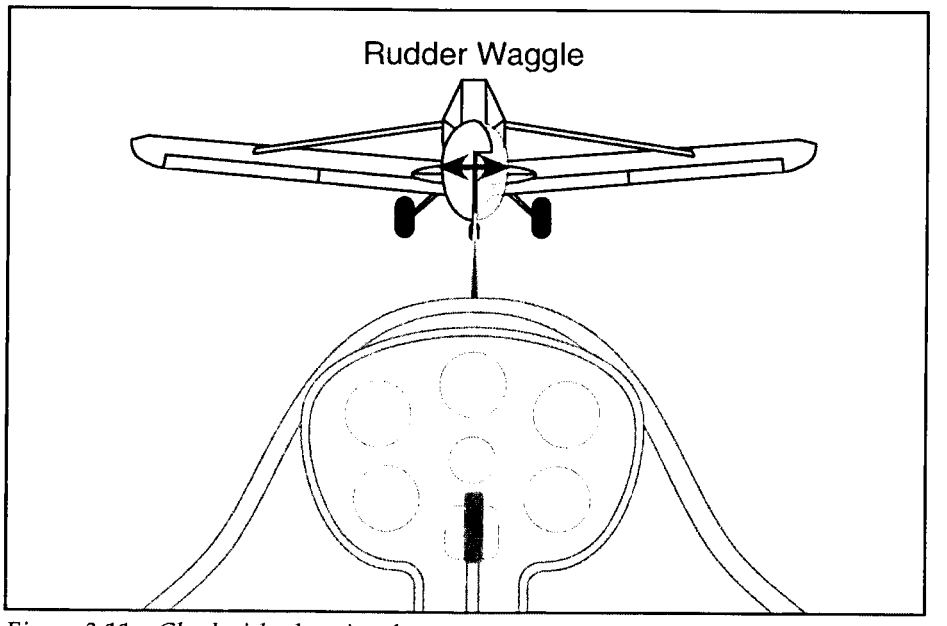


Figure 3.11 – Check airbrakes signal

Do NOT confuse the "rudder waggle" with the "rock off", or you could release yourself at low altitude with your airbrakes open—a very dangerous situation.

Common Errors

- Confusing the "speed up" and "slow down" signals
- Allowing the nose to yaw while performing the "speed up" signal
- Allowing the wings to rock while performing the "slow down" signal
- Not moving to the left when signaling that you can't release from tow
- Not releasing immediately when given the "rock off" signal
- Releasing when given the "rudder waggle"

Completion Standard

This lesson is complete when you can perform the glider aerotow signals, and when you interpret and react properly to the tow plane signals.

3.8 Boxing the Wake

Purpose

Boxing the wake is a maneuver used to demonstrate mastery of flying the aerotow. This maneuver consists of descending down through the wake, flying the glider in a rectangular pattern around the wake, then ascending back through the wake into normal tow position.

Procedure

Since you will be flying in a straight line for some distance while performing this maneuver, it is important that you check for converging traffic before starting to box the wake. If your glider is equipped with a radio, your instructor will probably let the tow pilot know that you will be practicing boxing the wake before you start the maneuver.

Your instructor will demonstrate boxing the wake, pointing out the visual references you should use to maintain vertical and horizontal position at each of the corners of the "box".

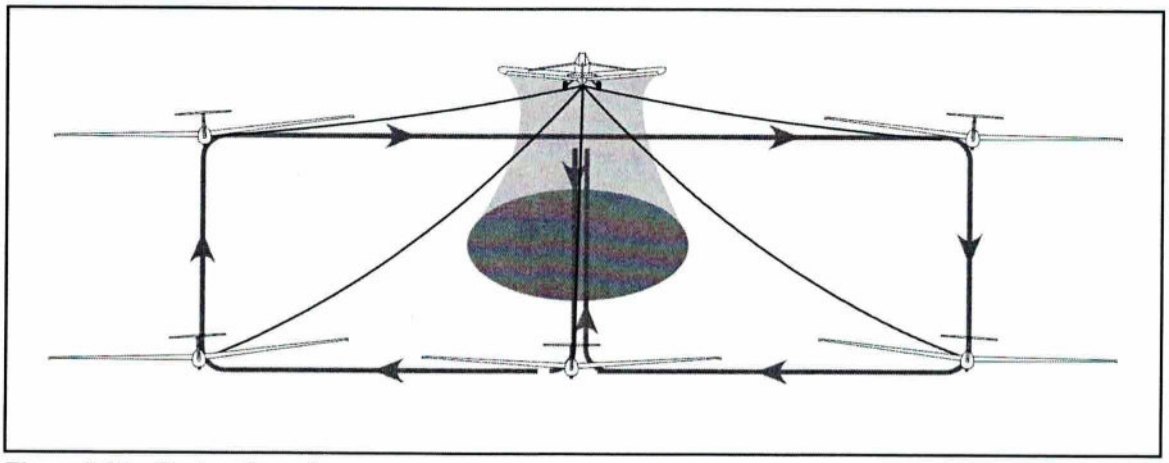


Figure 3.12 – Boxing the wake

When you fly this maneuver, you should not be in a hurry. Take your time and use small, deliberate control movements. In each "corner", stop for several seconds to stabilize and to demonstrate your ability to maintain your position. This is a maneuver to demonstrate precision, not speed.

Start to box the wake by descending from normal tow to low tow position. As always, when in low tow, you will probably have to hold a bit of forward pressure on the stick to keep from climbing.

Proceed to the four corners of the "box", then to low tow position, and finally back through the wake to normal tow position. When you are in the corners, you will have to hold some outside aileron and rudder to maintain position. In the lower corners, you will also have to hold some down elevator.

When transitioning from one top corner to the other, be careful not to build up too much sideways momentum. Again, use small bank angles, and don't rush the maneuver.

Common Errors

- Over-controlling or rushing
- Failure to maintain the desired position, both horizontal and vertical
- Trying to hold the glider to the outside using only the rudder
- Failure to pause in each corner

Completion Standard

This lesson is complete when you can consistently box the wake, maintaining proper vertical and horizontal alignment during each part of the maneuver.

3.9 Slack Rope on Tow

Purpose

If enough slack forms in the towrope, it could entangle the glider, or if the rope comes tight too abruptly, it could damage the glider or tow plane. In this lesson, you will learn to safely deal with a slack rope on tow.

Procedure

For slack to develop in the towrope, the glider must be flying faster than the tow plane. This can happen if the tow plane slows down (for instance, because of a sudden reduction in power), if the glider speeds up (for instance, because the glider abruptly descends), or because of turbulence.

For the slack to come out of the towrope, the glider must fly slower than the tow plane. When in straight, level flight, the glider will naturally start to slow down as soon as the rope goes slack, as long as you do not descend.

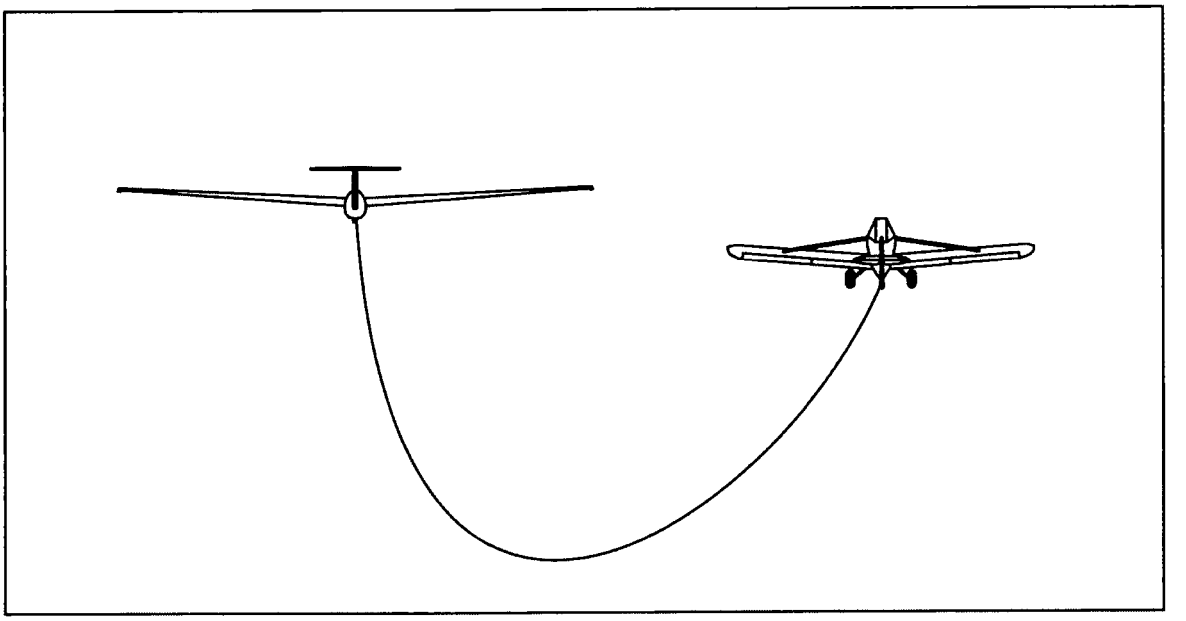


Figure 3.13 – Slack rope on tow. Climbing will help to remove the slack; descending will make it worse.

In most cases, if the glider pilot does nothing but stabilize the glider, the slack will take care of itself.

Avoid the Rope

The main priority when encountering slack is to avoid the rope and the tow plane. To do this, you must keep them in sight. If you lose sight of the rope or the tow plane, you should release the towrope immediately.

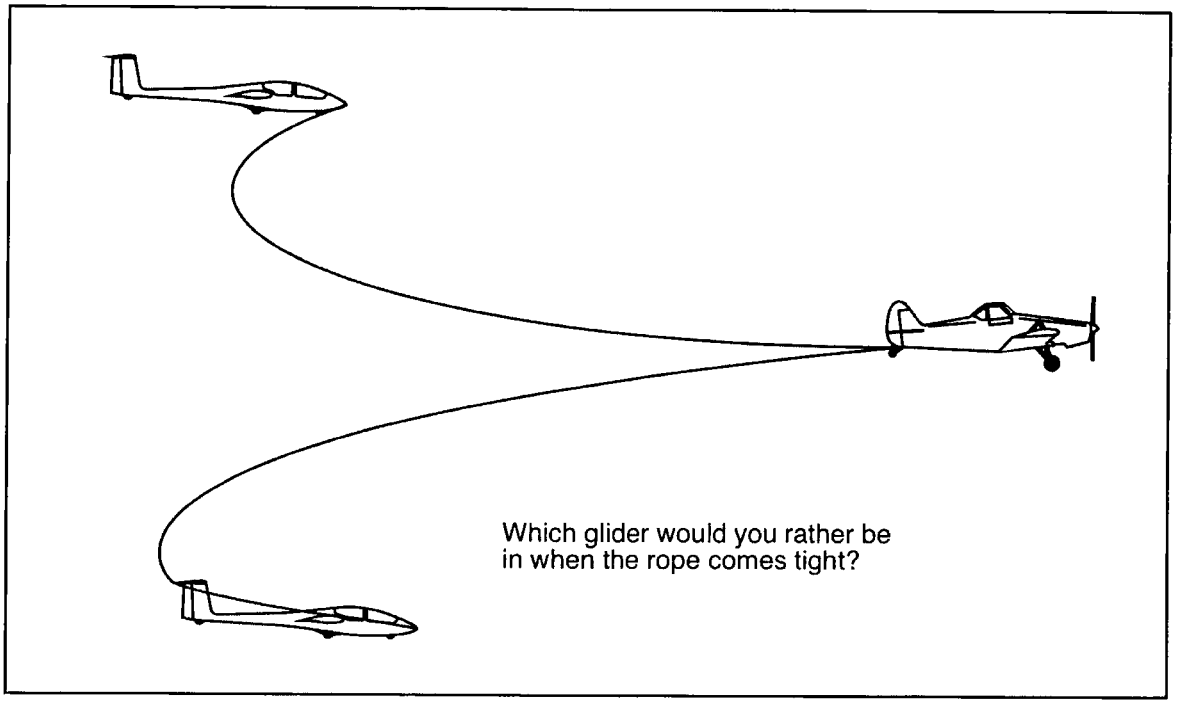


Figure 3.14 – Stay above the tow plane to avoid getting tangled in the slack rope.

The best way to keep the tow plane and rope in sight is to move to the side of, and slightly above the tow plane. This will also have the effect of reducing the slack since you will be moving away from the tow plane.

Stabilize/Slow Down

How you recover from a slack rope will depend partly on how much slack has developed. If there is a huge loop of slack, you will want to climb to slow down. This will remove some of the slack, and will give you some maneuvering room so that you can descend to accelerate to match the speed of the tow plane, to avoid jerking it and the glider as the rope comes tight. Be careful not to descend too quickly, or you will cause the slack to form again. Also, do not descend below the tow plane. If the rope breaks, you want to be above the tow plane so that the rope does not blow back over the glider.

If there is just a little slack in the rope, you can simply maintain a position to the side of the tow plane and let the rope come tight on its own as the glider loses speed. Again, stay above the tow plane to avoid the possibility of a broken rope hitting the glider.

Absorb Shock

Unless you exactly match the speed of the tow plane at the moment the rope comes tight, there will be some shock to the glider and the tow plane. If you are directly behind the tow plane when the rope comes tight, the rope will have to absorb all of this shock. However, if you are off to the side, the tow plane and the glider will both be yawed, which will help to dissipate the shock and reduce the likelihood of breaking the rope.

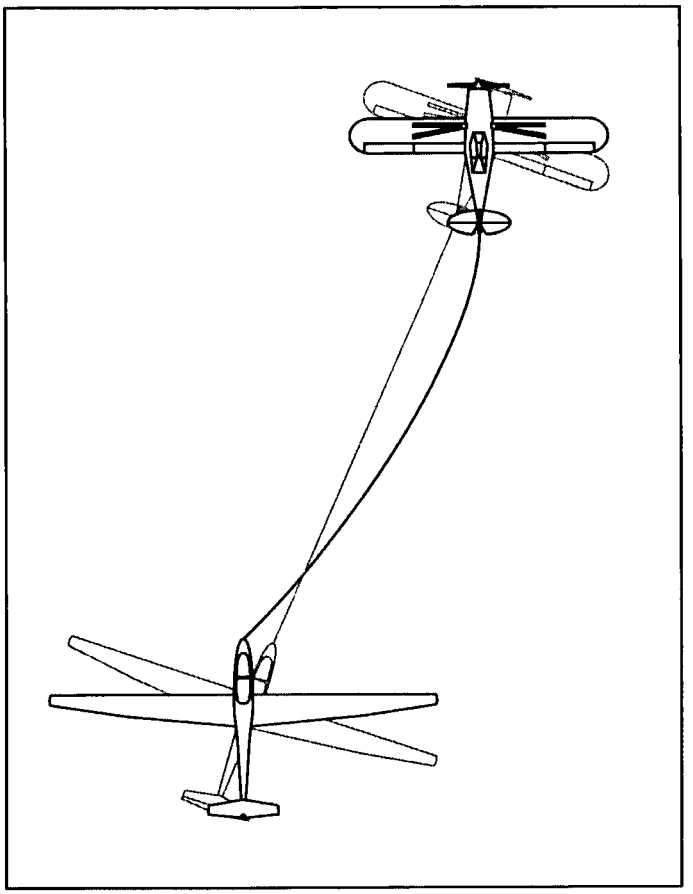


Figure 3.15 – Being to the side of the tow plane when the towrope comes tight will help to absorb the shock.

After the rope has come tight, you can slowly move back into normal tow position behind the tow plane.

Practicing Slack Rope Recovery

Your instructor will climb above the tow plane while in straight flight then abruptly lower the nose. This will cause the glider to speed up and cause slack in the rope. Your instructor will then give the controls to you.

You should first stabilize the pitch attitude to stop the descent, and then move out to the side of the tow plane if you are not already there.

As the rope starts to come tight, gently lower the nose of the glider to match the tow plane's speed, but do not descend below it.

If you ever lose sight of the tow plane or if the slack is coming out much too rapidly, pull the release to prevent breaking the rope or damaging the tow plane (or upsetting the tow pilot!).

Remember that most mild slack requires very little corrective action from the pilot. Over-controlling will just make the problem worse.

Common Errors

- Failure to stay off to the side of the tow plane to maintain visual contact with the rope
- Descending below the low tow position
- Descending too early or too abruptly so that there is still slack in the line when you are level with the tow plane
- Over-controlling
- Failure to release if the slack is coming out too fast, or if visual contact with the tow plane is lost

Completion Standard

This lesson is complete when you can recover from a slack line condition in straight flight with minimal stress to the rope, while at all times remaining above the tow plane.

3.10 Slack Rope in a Turn

Purpose

Recovering from slack during a turn is just slightly more complicated than recovering from slack in straight flight. In this lesson, you will learn how to deal with slack that develops in the rope during a turn.

Procedure

Slack can develop during a turn for the same reasons that it can develop during straight flight. In addition, slack can develop in a turn due to the glider pilot's flying too far to the outside of the turn. The glider is "whipped" around the outside of the turn, which causes its speed to increase. When the glider pilot tries to regain normal tow position, the glider will be moving faster than the tow plane, and slack will develop in the towrope.

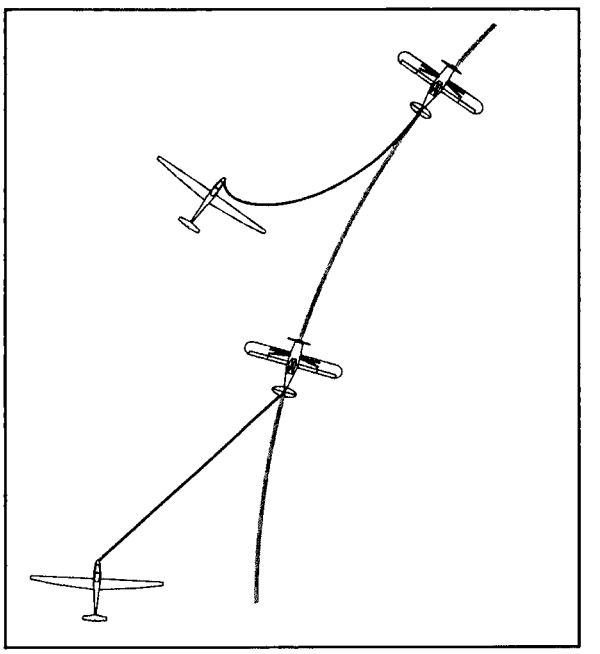


Figure 3.16 – Slack rope developing when a glider that is too far to the outside of a turn returns to normal tow position too quickly.

As slack develops, you should climb slightly above the tow plane (but not too high). This will help to reduce the slack by slowing the glider, and will give you room to maneuver when the rope starts to come tight.

To remove the slack, you must slow down the glider as you move back into position. This can be accomplished by increasing the drag on the glider with a slip or with the airbrakes. You must be cautious, however, not to slow down too much, or the rope will come tight very abruptly, and possibly break.

Before the rope comes tight, you should close the airbrakes or remove the slip. As the rope comes tight, you can descend slightly to match the speed of the tow plane.

Your instructor will demonstrate this maneuver by having the tow pilot start a turn. While the tow plane turns, your instructor will hold the wings of the glider level. As you get further and further out of position, you will feel the glider accelerate and try to climb. The instructor will then demonstrate that by judicious use of the airbrakes and/or a slip, the extra energy can be bled off as you regain your position behind the tow plane and continue the turn.

When it is your turn, your instructor will get you out of position in a turn, and then hand the controls over to you. You will notice that as you try to get back into position, the slack just seems to keep getting worse. This is because your speed is considerably higher than the tow plane's.

You can regulate how quickly the rope becomes slack by how quickly you move back behind the tow plane, as well as by how much drag you create (i.e., how aggressively you slip the glider or how much airbrake you apply). If you move into position slowly, the slack will form slowly. By opening the airbrakes as you start moving into position, you can regulate how much slack is in the line. If the slack gets worse, open the airbrakes more. Before the rope comes tight, close the airbrakes.

While this maneuver may seem difficult at first because of the sudden acceleration in the turn, you will find that with just a little practice, it is easy to perform. Just be careful not to climb too far above the tow plane when the rope is tight, because you can pull it into a spiral dive if you pull its tail up and to the outside of the turn.

As with any tow maneuver, if you ever feel you are about to break the rope, pull the release.

Common Errors

- Allowing the glider to get too far out to the side of the tow plane
- Trying to get back into position too quickly
- Descending below the tow plane
- Failure to close the airbrakes or remove the slip before the rope comes tight

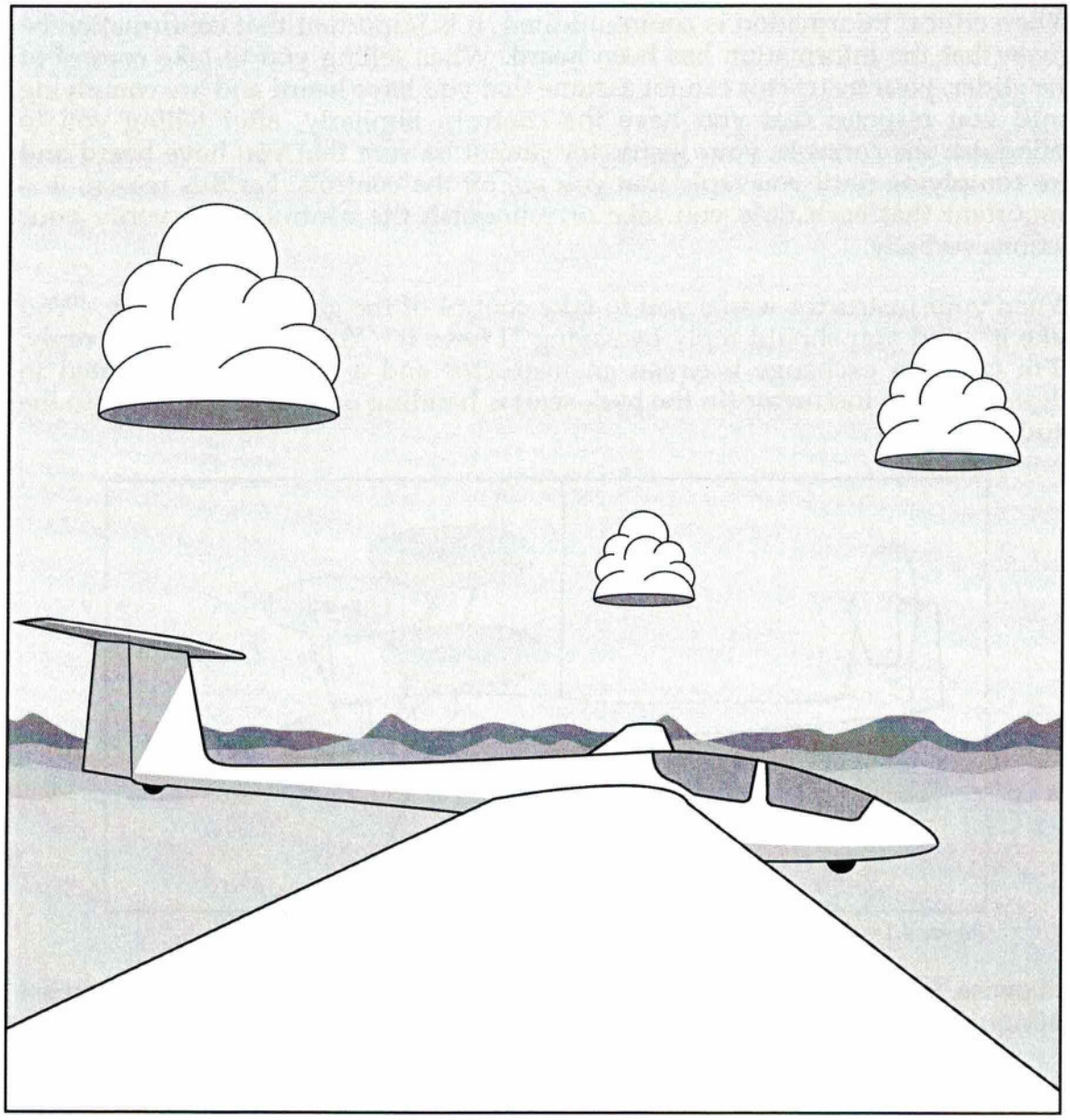
Completion Standard

This lesson is complete when you can remove slack from the rope that develops in a turn without undue stress to the rope, tow plane, or glider.

CHAPTER 4: IN-FLIGHT MANEUVERS

In this chapter, you will learn about the portion of flight between when the glider releases from the tow plane and when it enters the traffic pattern for landing.

In the first few lessons in this chapter, you will learn the basics of how to control the glider with the stick and rudder pedals, how to maintain a constant airspeed, and how to do gentle turns. Once you have mastered these basic skills, you will move on to more advanced maneuvers.



4.1 Transferring Control of the Glider

Purpose

Whenever two people fly together, whether a student and an instructor or two licensed pilots, it is essential that they know who is in control of the glider. A miscommunication can lead either to both pilots struggling against each other on the controls, or to the glider not being controlled at all. In this lesson, you will learn the procedures for passing control of the glider back and forth between you and your instructor.

Procedure

When critical information is communicated, it is important that confirmation be given that the information has been heard. When telling you to take control of the glider, your instructor cannot assume that you have heard and are complying until you respond that you have the controls. Similarly, after telling you to relinquish the controls, your instructor cannot be sure that you have heard and are complying until you reply that you are off the controls. For this reason, it is important that each time you take or relinquish the controls, you verify your actions verbally.

When your instructor wants you to take control of the glider, he will say, "You take it", and you should reply by saying "I have it". Your instructor will reply, "I'm off". An exchange between an instructor and a student is illustrated in Figure 4.1. The instructor (in the back seat) is handing control of the glider to the student.

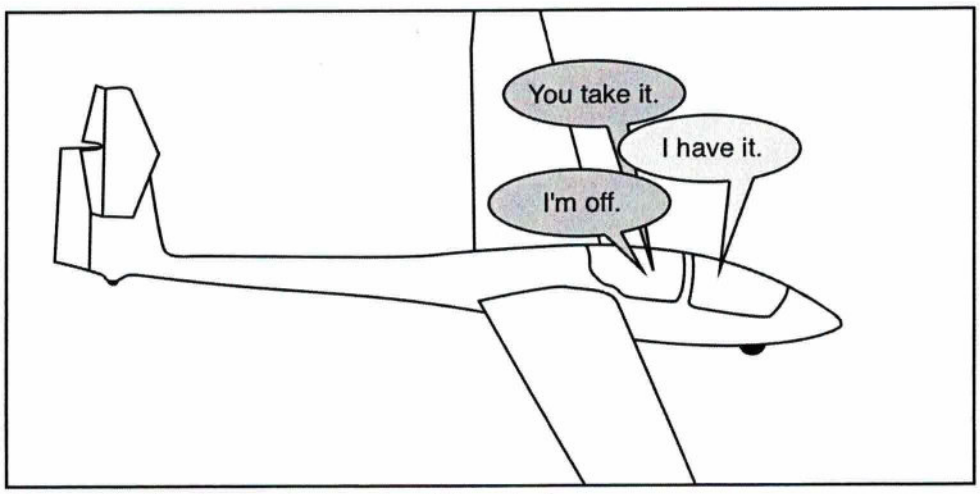


Figure 4.1 – Confirming the transfer of the controls

Likewise, when your instructor says, "I have it," you should confirm that you are relinquishing the controls by saying, "I'm off."

If you are ever confused about who is supposed to be in control, ask.

Common Errors

- Failure to verify that you have relinquished the controls
- Failure to verify that you have taken the controls

Completion Standard

This lesson is complete when you consistently verify each transfer of the controls between you and your instructor.

4.2 Scanning for Traffic

Purpose

We share airspace with aircraft of all types. It is every pilot's responsibility to see and avoid other traffic. In this lesson, you will develop the habit of constantly and effectively scanning for traffic.

Procedure

Aircraft that are at your approximate altitude and therefore are a possible collision hazard will appear near the horizon. You should concentrate your scan for traffic in this area.

When you are in straight flight, any aircraft that is on a collision course with you will appear stationary in your field of vision. There will be no apparent relative motion between you and the other aircraft.

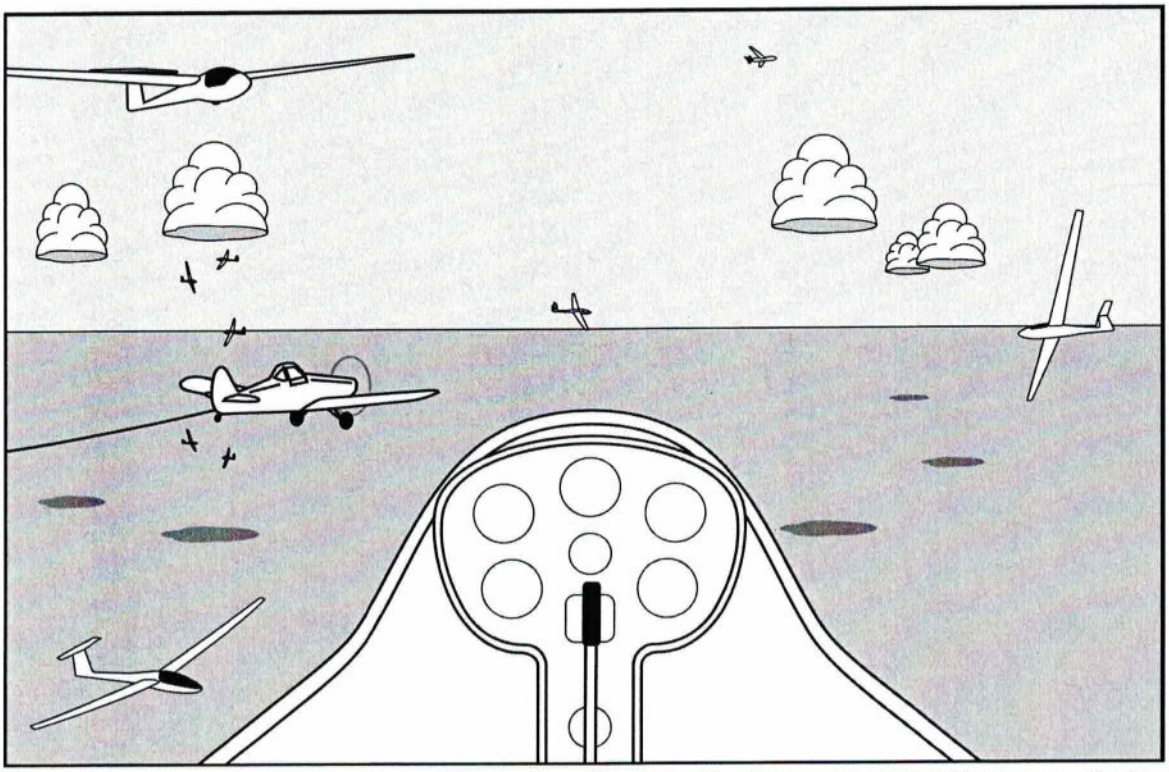


Figure 4.2 – Concentrate your scan near the horizon. The aircraft of most concern in this view are the tow plane near the horizon on the left and the glider on the horizon to the right.

When initiating a turn, you must look not only in the direction of the turn, but also in the opposite direction. Faster aircraft could overtake you once you have turned. Remember, a glider is about the slowest thing in the sky without feathers!

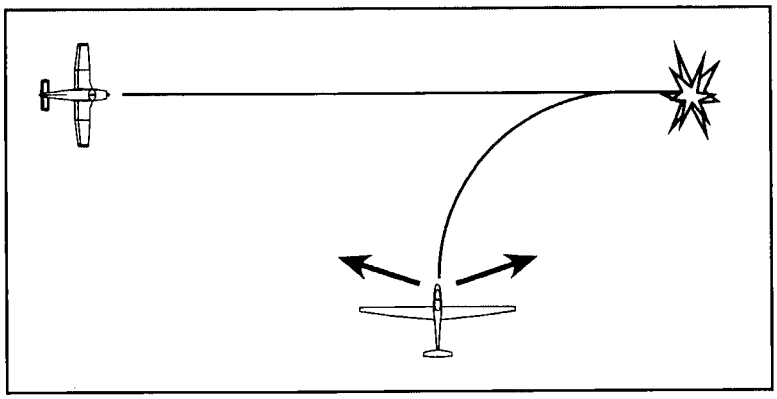


Figure 4.3 – Look in both directions before initiating a turn.

During a turn or while thermaling, it is important to continually clear the area for approaching traffic. To do this, you first gaze at a fixed point on the horizon in the direction of the turn. As the turn proceeds, the nose will eventually be pointing in the same direction you are gazing. You can quickly check the airspeed, variometer, yaw string, and pitch angle. Then, pick another point on the horizon and repeat.

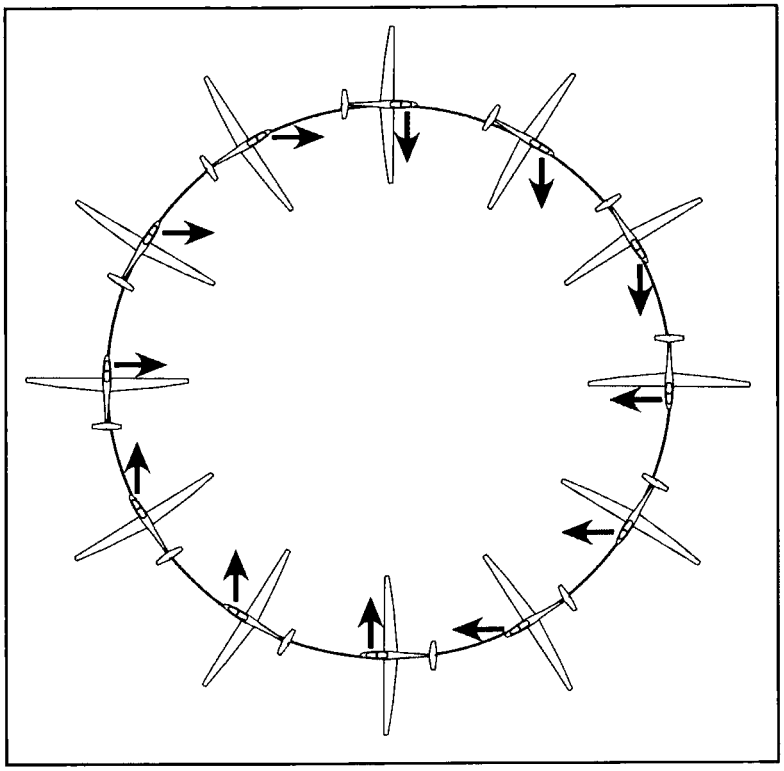


Figure 4.4 – To scan for traffic when thermaling, look at the horizon in the direction of the turn and wait for the nose of the glider to align with your view. Check the instruments and pitch angle, and repeat.

For bank angles of 45° or greater, you should clear the area in 90° segments as illustrated in Figure 4.4. For shallower bank angles and thus lower turning rates, you should clear the area in about 45° segments.

Keep in mind that haze, smoke or anything that decreases visibility will cause both traffic and terrain to appear to be more distant.

Common Errors

- Failure to scan regularly during level flight
- Failure to clear both directions before turning
- Failure to continually scan while thermaling

Completion Standard

This lesson is complete when you continuously scan for traffic while turning, without being prompted or reminded by your instructor.

4.3 Pitch/Speed Control

Purpose

In this lesson, you will learn how to maintain a desired airspeed by controlling the pitch attitude of the glider using the elevator.

Procedure

Although it seems counterintuitive, the best way to control the airspeed of the glider is *not* to look at the airspeed indicator. Instead, you should look at the position of the glider's nose with respect to the horizon.

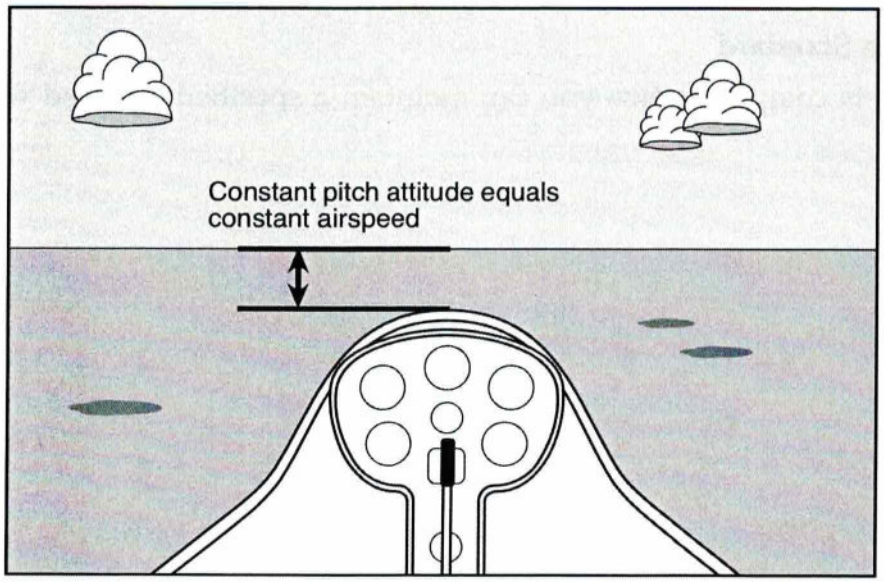


Figure 4.5 – Control airspeed by monitoring pitch attitude, not the airspeed indicator.

If you fly the glider at a constant pitch attitude, the airspeed will be constant. To go faster, you lower the nose. To go slower, you raise the nose. For each pitch attitude, there is a corresponding equilibrium airspeed.

You should note what the "normal" pitch attitude looks like in the glider. The view over the nose is different for each person, and can vary with the position of the seat, the thickness of the seat cushions, etc.

You should concentrate on noticing changes in the pitch angle. As soon as you notice a change, you should take action to return the nose to the correct position using the elevator.

The process of changing to a new airspeed is an iterative one. First estimate what the pitch angle should be for the desired airspeed, and then adjust the nose angle accordingly. You must hold the pitch angle constant until the glider reaches its equilibrium airspeed, and then check the airspeed indicator to see if the desired airspeed was reached. If so, great. If not, repeat the process.

Do not stare at the airspeed indicator while adjusting the pitch attitude. If you do, you will constantly be "chasing the airspeed" because of the lag between the control inputs and the change in airspeed. Instead, look over the nose and glance at the airspeed indicator to confirm that your pitch attitude is correct.

Common Errors

- Failure to maintain a constant pitch attitude
- Failure to notice and react to movement of the glider's nose
- Staring at the airspeed indicator

Completion Standard

This lesson is complete when you can maintain a specified airspeed within ±10 knots.

4.4 Using the Trim Control

Purpose

There is one airspeed the glider will try to fly if no pressure is put on the stick. The trim control allows the pilot to adjust this airspeed. In this lesson, you will learn to trim the glider at different airspeeds using the elevator trim control.

Procedure

Before launch, your instructor will show you how to adjust the trim on the glider. Once in the air, your instructor will assign you a target airspeed. You should estimate what pitch angle will result in the desired airspeed, and then adjust the nose angle accordingly. You know that if the target airspeed is faster than your current airspeed, you will have to lower the nose, and if it is slower, you will have to raise it.

Once you have established the desired pitch attitude, check the airspeed indicator to see how close you are to the target airspeed. Once again, if you are too slow, lower the nose. If you are too fast, raise the nose. Continue adjusting the pitch and checking the airspeed until you have reached the target airspeed.

Once at the target airspeed, you should adjust the trim to remove any force on the stick. Once the glider has been properly trimmed, you should be able to let go of the stick and have the glider maintain its pitch angle. It is very important that while you adjust the trim, you keep the nose attitude absolutely constant; otherwise, you will trim for an attitude different than the one corresponding to the target airspeed.

Common Errors

- Allowing the nose to pitch up or down before the equilibrium airspeed is reached
- Taking too long to achieve a change in airspeed
- Staring at the airspeed indicator instead of the pitch attitude
- Failure to maintain a constant pitch attitude while adjusting the trim

Completion Standard

This lesson is complete when you can adjust the pitch to achieve the desired airspeed, and can quickly trim the glider for "hands-off" flight within ±5 knots of the desired airspeed.

4.5 Shallow/Medium Bank Turns

Purpose

The purpose of this lesson is to teach you to turn the glider using coordinated application of the ailerons and rudder.

Procedure

A turn can be divided into three steps. First, you initiate the turn by establishing the desired bank angle. Second, you sustain the turn by maintaining a constant pitch and bank angle. Third, you end the turn by leveling the wings.

You initiate the turn by using the ailerons and rudder together to establish the desired bank angle. (In this lesson, you will be using bank angles of less than 30°.) You use the ailerons to bank the wings and the rudder to counteract adverse yaw. As soon as you achieve the desired bank angle, neutralize both the ailerons and rudder.

While the wings are banked, you must apply enough back-pressure on the stick to keep the nose from dropping. The steeper the bank angle, the more back-pressure you will need. Maintain your bank angle using coordinated aileron and rudder inputs, as necessary.

As you approach your desired heading, roll the glider's wings back to level by applying coordinated aileron and rudder. Release the back-pressure on the stick to keep the nose from rising as you level the wings.

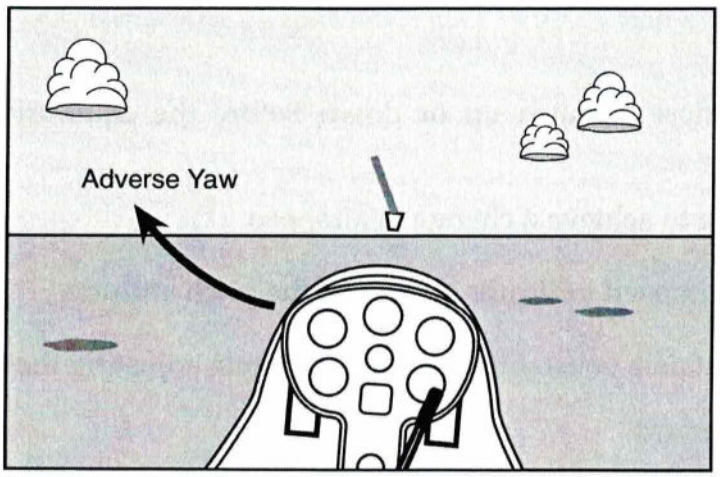


Figure 4.6 – If rudder is not used to counteract adverse yaw, the glider will yaw towards the rising wing.

Your instructor will demonstrate the effects of adverse yaw by initiating a turn without using any rudder. The nose of the glider will swing to the outside of the turn. If no rudder is used when rolling out of a turn, the nose will swing to the inside of the turn.

Next, your instructor will demonstrate a properly coordinated turn. The nose will appear to rotate about a point on the horizon, and then translate parallel to the horizon, in the direction of the turn. As your instructor rolls out of the turn, the nose will again rotate about a point on the horizon and stop once the wings are level.

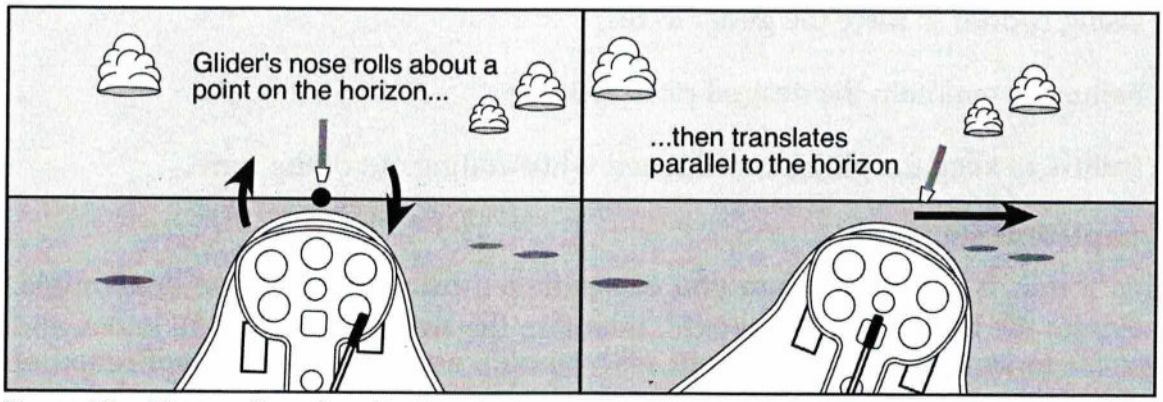


Figure 4.7 – The coordinated application of aileron and rudder causes the glider's nose to rotate about a point on the horizon. As the desired bank angle is achieved, the ailerons and rudder are neutralized, and enough back stick is applied to keep the nose translating parallel to the horizon.

Your instructor will now transfer the controls to you. You will roll the glider to the desired bank angle using coordinated aileron and rudder control. If, as you initiate the turn, the nose rotates about a point on the horizon without swinging to the inside or outside of the turn, you are using the correct amount of rudder to compensate for adverse yaw. If the nose swings to the inside, use less rudder. If the nose swings to the outside, use more rudder.

Once you are in the turn, neutralize the ailerons so that the bank angle doesn't continue to increase. You should also bring the rudder pedals back to the center, since there is no adverse yaw when the ailerons are neutral.

Back stick will be required to keep the nose from dropping. To maintain constant airspeed in a shallow or medium banked turn, you need to maintain a constant distance between the nose and the horizon, just as when flying straight and level.

To roll out of the turn, you must use the ailerons to level the wings, along with rudder to counteract adverse yaw. Once again, watch the nose to determine if you are using the correct amount of rudder. The nose should not swing to either side.

You will notice as you roll out of a turn that the nose will try to pitch up as the wings are brought level. You will need to keep an eye on the pitch attitude and ease the stick forward to keep this from happening so that the airspeed stays constant.

Common Errors

- Failure to keep the glider coordinated while rolling into the turn
- Failure to maintain a constant bank angle during the turn
- Using rudder to force the glider to turn
- Failure to maintain the desired pitch attitude
- Failure to keep the glider coordinated while rolling out of the turn

Completion Standard

This lesson is complete when you can initiate a turn to a specified bank angle, maintain the bank angle within ±5°, maintain the airspeed within ±10 knots, and recover to straight and level flight with smooth and coordinated application of the controls.

4.6 Precision Turns

Purpose

Whether you are navigating on a cross-country flight or simply flying a pattern, the ability to roll out on a desired heading is an important skill to have. In this lesson, you will learn to make turns to a precise heading.

Procedure

By now you have mastered using the controls to keep the glider coordinated while rolling into and out of a turn. To master precision turns, you simply need to pay extra attention to your desired final heading and make sure that you level the wings sufficiently early so as not to overshoot. If you find that you have started to level your wings too early, you simply keep turning at the reduced bank angle until you reach the desired heading, then finish leveling the wings.

If you are only making a heading change of a few degrees, use small bank angles. If you are changing heading by 90° or more, you should use a bank angle of approximately 45°. This bank angle will cause you to lose the least amount of altitude during the turn.

Your instructor will tell you to turn the glider toward different landmarks. You should clear the area and turn quickly but smoothly toward the landmark, keeping the glider coordinated and the airspeed constant.

Your instructor may ask you to turn the glider to a specific compass heading. Since the compass is not accurate during a turn, you should first note the current heading, and then estimate the position of a landmark on the horizon that corresponds to that heading. For example, if you are on a heading of 100°, and your instructor asks for a heading of 190°, you should look for a landmark on the horizon off your right wing, then turn the glider to that landmark. Once you have leveled your wings, use the compass to verify that you are on the desired heading.

Common Errors

- Failure to use a bank angle appropriate to the desired heading change
- Failure to establish the desired heading

Completion Standard

This lesson is complete when you can maintain an appropriate rate of turn to a specified heading within ±10° using smooth and coordinated control movements, while maintaining a desired airspeed within ±10 knots.

4.7 Airbrakes in Flight

Purpose

Airbrakes are used to control the glide slope during the approach and landing. The purpose of this lesson is to teach you how to operate the airbrakes, and to demonstrate the effect that the airbrakes have on pitch attitude.

Procedure

Since you will lose significant altitude while the airbrakes are open, you should clear the area before practicing using the airbrakes. Perform a clearing turn of at least 180° (or two 90° turns). You should also make sure that you have plenty of altitude, so that you do not get so low that you are unable to make it back to the airport.

Some gliders experience a pitch change when the airbrakes are open. Your instructor will tell you whether the glider you are flying has a tendency to pitch nose up or down when the airbrakes are applied.

Your instructor will have you trim the glider for a normal pattern airspeed. When you open and close the airbrakes, be sure to keep the airspeed constant. The more the airbrakes open, the lower you will have to hold the nose of the glider with respect to the horizon in order to hold the airspeed constant. The more smoothly you open or close the airbrakes, the easier it will be to compensate for the resulting pitch change. Your instructor will have you practice airspeed control at different airbrake settings.

You will lose altitude rapidly with the airbrakes open, so be aware of your position at all times, and leave yourself enough altitude to make it to your pattern entry point.

Common Errors

- Opening or closing the airbrakes too abruptly
- Failure to maintain a constant airspeed when changing the airbrake setting

Completion Standard

This lesson is complete when you can maintain the specified airspeed within +10/-5 knots while transitioning between different airbrake settings.

4.8 Steep Turns

Purpose

To change direction rapidly or to stay in a small thermal, you will need to fly the glider at relatively steep bank angles. In this lesson, you will learn how to control the glider at bank angles between 30° and 60°.

Procedure

The radius of a turn is dependent on the glider's bank angle. The steeper the bank angle is, the smaller the radius of the turn will be. Increasing the bank angle also increases the rate of turn.

The Physics of a Steep Turn

G-forces are much more noticeable in a steep turn than in a shallow turn. At a bank angle of 30°, the glider is pulling only 1.15 G's. At 45°, the loading increases to 1.41 G's, and at 60°, it is 2 G's. Beyond 60° of bank, G-forces increase rapidly, making sustained turns increasingly uncomfortable.

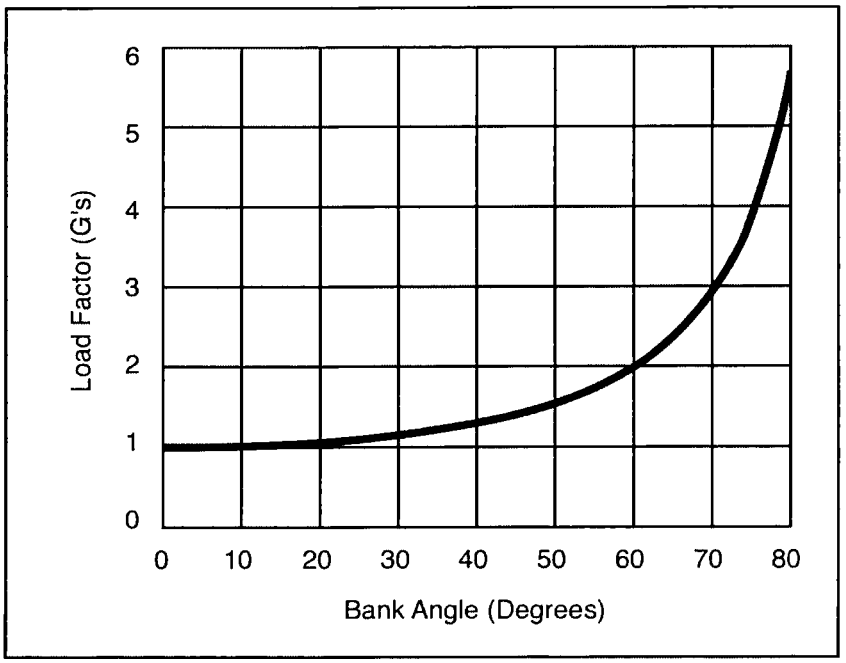


Figure 4.8 – The load factor increases rapidly beyond a bank angle of 60°.

Because of the higher wing loading, the glider will reach its critical angle of attack at a higher airspeed than in straight and level flight. The stall speed increases at the square root of the load factor. For instance, at a 60° bank angle (a load factor of 2), the stall speed will be increased by a factor of 1.4 (the square root of 2). In other words, a glider that stalls at 40 knots in straight and level flight will stall at 56 knots in a 60° banked turn.

In a steep turn, the outside wing tip is traveling significantly faster than the inside wing tip. The outside tip therefore creates more lift, making the glider tend to increase its bank angle, or "over-bank". This requires that you use aileron input towards the high wing to keep the wings at the desired bank angle.

Determining the Bank Angle

A bank angle of 45° is the "standard" steep turn, which is convenient, since this is the only bank angle for which we have a reference of any kind in the glider. The instrument mounting screws are arranged in a square around the instruments. If you bank the glider such that an imaginary line connecting two diagonal instrument screws is parallel to the horizon, then the glider will be in a 45° bank, as shown in Figure 4.9.

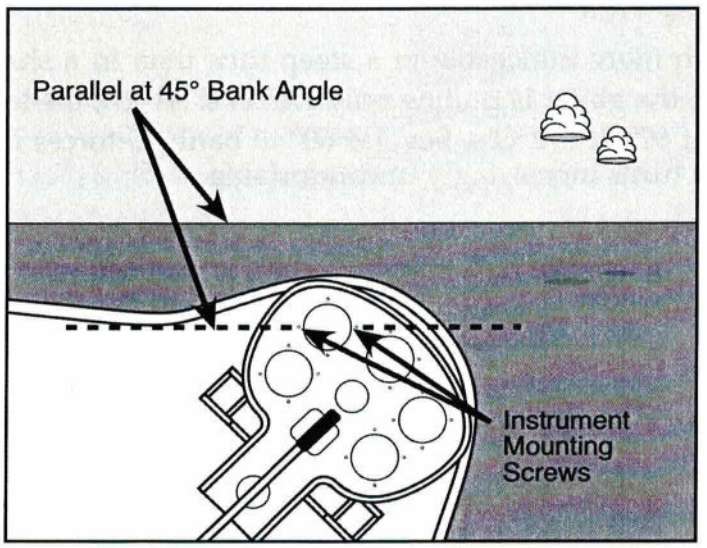


Figure 4.9 – When a line connecting a diagonal pair of instrument mounting screws is parallel to the horizon, you are in a 45° bank.

This should be your target bank angle in this lesson unless your instructor indicates otherwise.

Performing a Steep Turn

As with any turn, the first step to entering a steep turn is to look both directions for traffic. Then, you should establish the desired airspeed, remembering that you will need higher airspeed for steeper the bank angles.

You will then establish and hold the desired bank angle using coordinated aileron and rudder inputs. Note that to keep the airspeed constant, significant back-pressure will be required on the stick, and as this back-pressure is applied, the G-forces will increase. Some students are reluctant to provide this back-pressure because of the instant feedback of higher G-forces. Realize that these G-forces are a necessary part of a steep turn.

Maintain a constant bank angle and airspeed while in the steep turn. You will probably notice that you need to provide some "top aileron" to prevent the glider from over-banking. Remember to continue to clear for traffic while you are in the turn.

When instructed to do so, you should return to level flight. The glider will have a tendency to nose up during the recovery. Ease up on the back-pressure so that the airspeed does not decrease during the recovery.

At very steep bank angles, you will no longer be able to control the airspeed with the elevator. If you try to slow the glider with elevator, you will simply tighten the turn, increasing the loading considerably. Instead, at bank angles near and above 60°, you will need to decrease the bank angle before you can slow down.

Common Errors

- Failure to establish an airspeed appropriate to the bank angle before entering the turn
- Failure to maintain a constant airspeed during the turn
- Failure to maintain a constant bank angle during the turn

Completion Standard

This lesson is complete when you can consistently perform steep turns, maintaining the specified bank angle within ±10° and the specified airspeed within ±10 knots throughout the turn.

4.9 Circling Flight

Purpose

To be able to thermal effectively, you must be able to maintain a constant airspeed and bank angle while continuously turning. In this lesson, you will learn to perform multiple 360° turns at moderate bank angles.

Procedure

If the bank angle or airspeed changes while you are turning, the radius of the turn will also change. A decrease in bank angle or an increase in airspeed will increase the turn radius. An increase in bank angle or a decrease in airspeed will tighten the turn.

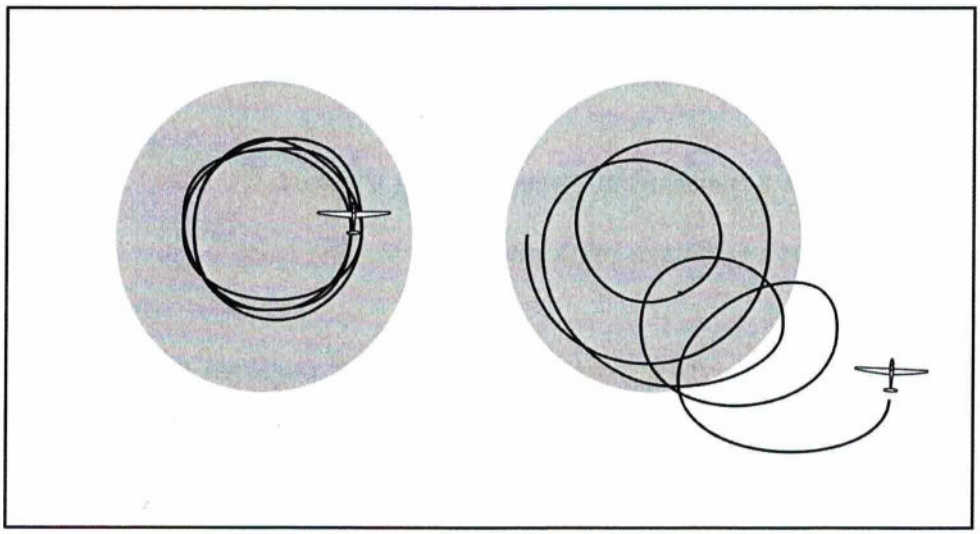


Figure 4.10 – Maintaining constant bank and pitch angles allows you to fly consistent circles, as shown on the left. If you allow the bank and pitch angles to vary, you will wander out of the thermal, as shown on the right.

You must pay particular attention to keeping the bank and pitch angles constant while in the turn. Any errors will accumulate. For example, if you allow the bank angle to increase, the radius of the turn will decrease, and the glider will tend to speed up. If you allow the nose to pitch up on one side of the circle, the speed and therefore the radius of the turn will decrease. The nose will then tend to dip on the other side of the circle, increasing the radius of turn on that side. You must watch for small errors and fix them before they get worse.

Several things that can cause uncoordinated flight during the turn (as opposed to the entry into and exit out of the turn). If you deflect the rudder in the direction of the turn, you will force the glider to skid. If you deflect the rudder to the outside of the turn, you will cause a slip.

If you find the glider slipping during the turn (i.e., the yaw string is pointing to the outside of the turn) even though you are holding the rudder neutral, you are probably not holding enough back-pressure on the stick. The glider will slip until

the vertical stabilizer aligns the glider with the airflow (at which time, the nose of the glider will be lower and the airspeed will increase). If you keep the nose of the glider at the correct pitch attitude, and the bank angle constant, the glider should stay coordinated.

Common Errors

- Failure to maintain a constant bank angle during the turn
- Failure to maintain a constant pitch angle during the turn
- Failure to respond quickly to changes in the bank and pitch angles

Completion Standard

This lesson is complete when you can indefinitely maintain a turn at a specified bank angle within ±5° and at a specified airspeed within ±10 knots with smooth and coordinated application of the controls.

4.10 Crabbing During Cruising Flight

Purpose

When you fly in a crosswind, the direction the glider is traveling over the ground will not be the same as the direction the glider is pointing. In this lesson, you will learn to adjust the glider's flight path to compensate for a crosswind.

Procedure

The track of the glider is the path that it follows over the ground. The heading of the glider is the direction that the nose of the glider is pointing. The difference between these two directions is the crab angle.

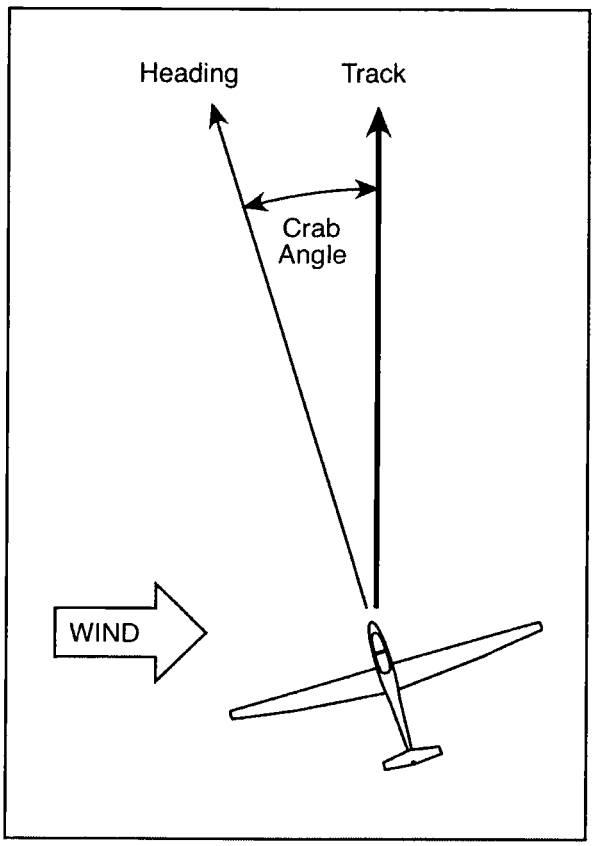


Figure 4.11 – The crab angle is the difference between the heading and the track caused by a crosswind component.

If there is a crosswind, you will have to point the nose of the glider into the wind in order to achieve the desired track.

To establish the crab angle, use coordinated control inputs. To maintain the crab angle, hold the controls neutral. It is important to realize that crabbing flight is normal, straight, coordinated flight. During crabbing flight, the yaw string should point straight back, and the wings should be level.

When there is sufficient wind, your instructor will tell you to track toward a landmark that is situated so you will have a crosswind. You first establish a heading by guessing how much crab angle is needed. If you find yourself tracking downwind of the desired track, you should increase the crab angle (i.e., alter the heading more into the wind). If you find yourself tracking upwind of the desired track, you should decrease the crab angle.

Common Errors

- Trying to match the glider's heading with the track by using the rudder
- Failure to notice that the glider's track does not match the desired flight path

Completion Standard

This lesson is complete when you can adjust the crab angle to maintain a specified ground track within ±10° using smooth and coordinated control inputs.

4.11 Stall Recognition and Recovery in Level Flight

Purpose

Many accidents are caused by unintentionally stalling the glider close to the ground. In this lesson, you will learn to recognize the warning signs of a stall and to recover from a stall that occurs during straight and level flight.

Procedure

Because stalls can involve a significant loss of altitude, you should clear the area around and below you for traffic before practicing stalls. Perform a clearing turn of at least 270° before stalling the glider. During your clearing turn, use a bank angle of at least 45° so that you have a clear view below the glider. A steeper turn also takes less time, decreasing the chance that an aircraft will fly into an area you have already cleared.

You should be at an altitude that will allow you to recover no lower than 1,500 feet above the ground.

Once the area has been cleared, your instructor will demonstrate a stall while describing the warning signs. These include, in order:

- Stick back
- Nose high or rising
- Decreasing airspeed
- Decreasing wind noise
- Mushy controls
- Buffeting

You must decrease the angle of attack to recover from the stall. Your instructor will demonstrate this by easing the stick forward until the nose is slightly below the target pitch attitude, and, when proper flying speed is regained, reestablishing the target pitch angle.

You will then practice clearing the area, stalling the glider, and recovering from the stall on your own. To enter the stall, bring the nose of the glider above the horizon and maintain this pitch attitude until the airspeed decreases and the glider stalls.

As the glider stalls, the nose will naturally drop. It is important that you let this happen, and let the glider pick up speed before raising the nose to the normal pitch attitude. If you try to hold the nose at the normal pitch attitude before the

glider is un-stalled, you will keep the glider in the stall, which could then develop into a spin.

On the other hand, do not let the nose drop too far, causing the glider to gain too much airspeed before recovering to a normal pitch attitude. You want to get the glider flying again as quickly as possible in order to lose the least amount of altitude. Do not let the nose rise above the normal pitch attitude during the recovery, or you may enter a secondary stall.

Common Errors

- Failure to clear the area before intentionally stalling the glider
- Moving the stick too far forward when recovering from the stall, causing excessive airspeed and unnecessary loss of altitude
- Trying to keep the nose from dropping by pulling back harder on the stick as the glider stalls
- Allowing the nose to rise above the horizon during the recovery

Completion Standard

This lesson is complete when you can list and recognize the warning signs of a stall, and can recover from a stall in level flight with minimal loss of altitude.

4.12 Stall Recognition and Recovery in a Turn

Purpose

The aerodynamic asymmetry present during a turn can cause the glider to exhibit stall behavior that is different from that in straight and level flight. In this lesson, you will learn to recognize and recover from a stall that occurs during a turn.

Procedure

During a turn, the glider is aerodynamically asymmetrical. The inside wing is traveling slower, and is therefore at a higher angle of attack. This can cause the inside wing to stall before the outside wing. If this happens, the inside wing will drop, and the ailerons will not be effective at raising it. In fact, by deflecting the aileron down on the inside wing, you will further increase the angle of attack, deepening the stall. If a proper recovery is not initiated promptly, the stall can develop into a spin.

After clearing the area for traffic, your instructor will demonstrate the procedure for initiating a stall from a shallow banked turn by raising the nose of the glider above the horizon and holding it there as the airspeed decays.

In a turn, the glider will exhibit the same stall warning signs as it did in straight flight:

- Stick back
- Nose rising (As the bank angle increases, this will be less noticeable.)
- Decreasing airspeed
- Decreasing wind noise
- Mushy controls
- Buffeting

Your instructor will keep the bank angle constant until the glider stalls. As the glider buffets, your instructor will neutralize the ailerons and ease the stick forward to reduce the angle of attack until the glider regains flying airspeed. The ailerons can then be used to recover to the initial bank angle.

You will then perform a stall and recovery from a turn on your own. As you slow the glider down, you will notice a tendency for it to over-bank. Until the glider stalls, you should keep the wings at the desired bank angle using coordinated aileron and rudder. As the glider buffets, you must neutralize the ailerons to keep from exacerbating the stall on the inside wing.

If the nose starts to rotate in the direction of the turn, you should apply opposite rudder to stop the rotation. Remove the rudder input as soon as the rotation stops.

As the glider stalls, in addition to bringing the ailerons back to the neutral position, you must move the stick forward to decrease the angle of attack. Not until the glider is "un-stalled" should you pick up the low wing using the ailerons.

Common Errors

- Failure to clear the area before intentionally stalling the glider
- Failure to maintain the desired bank angle before the stall
- Failure to initiate a recovery at the first sign of a buffet
- Trying to use the ailerons to raise a stalled wing
- Allowing the nose to rise above the horizon during the recovery
- Failure to return to the initial bank angle after the recovery

Completion Standard

This lesson is complete when you can list and recognize the warning signs of a stall, and can recover from a stall in a turn with minimal loss of altitude. Leading up to the stall, you must be able to maintain a specified bank angle within ±10°.

4.13 Slow Flight

Purpose

When flying in lift, the glider is often flown very slowly, since the minimum sink airspeed is usually just above the stall speed. It is therefore important that you become familiar with the behavior of the glider at minimum controllable airspeed (MCA). Slow flight is also good practice for recognizing and responding to the warning signs of a stall.

Procedure

After clearing the area, you will trim the glider to fly just above the stall speed in straight and level flight. If the glider experiences any buffeting or if the controls lose effectiveness, you should gently lower the nose to prevent a stall from occurring. You should not lower the nose so much that the airspeed increases by more than a couple of knots unless the glider has fully stalled.

While flying slowly, it is important to use small bank angles when turning to keep the increased load factor from causing a stall. The minimum controllable airspeed increases with increasing bank angle.

You should use very small and smooth control movements when flying slowly. The increase in angle of attack resulting from abrupt aileron or elevator deflection could cause the wing to stall.

At low airspeeds, induced drag is higher, and therefore adverse yaw will be greater. You will notice that you have to use more rudder to coordinate your turns when flying at the minimum controllable airspeed.

Common Errors

- Failure to trim the glider for the desired airspeed
- Failure to react to buffeting
- Failure to maintain the desired bank angle
- Failure to fly at an airspeed appropriate to the bank angle being flown

Completion Standard

This lesson is complete when you can fly at the minimum controllable airspeed appropriate to the specified bank angle, adjusting the pitch attitude as necessary to prevent a stall. You must be able to maintain a heading of ±10° when in level flight, and maintain a specified bank angle within ±10° when in turning flight.

4.14 Stall Recognition and Recovery with Airbrakes

Purpose

Typically, a stall with the airbrakes open would happen in the landing pattern, at low altitude, with little room for recovery. In this lesson, while at a safe altitude, you will learn to recognize and recover from a stall that occurs while the airbrakes are deployed.

Procedure

In most gliders, when the airbrakes are open, the glider buffets slightly. This tends to mask the buffeting from a stall. You must therefore pay particular attention to the other warning signs of a stall when you have the airbrakes open.

Most airbrakes disrupt the airflow over part of the wing. Since this part of the wing is no longer producing lift, the rest of the wing must work harder (i.e., be at a higher angle of attack) when the airbrakes are open. Often, simply closing the airbrakes will cause the glider to recover from a stall. When the airbrakes are closed, the sink rate, and thus the angle of attack, immediately decreases.

After clearing the area for traffic, your instructor will demonstrate the procedure for initiating a stall with the airbrakes open by opening the airbrakes about halfway, then raising the nose of the glider above the horizon and holding it there as the airspeed decays.

As usual, the warning signs of the stall are:

- Stick back
- Nose rising
- Decreasing airspeed
- Decreasing wind noise
- Mushy controls
- Buffeting (may be partially masked by the buffeting from the airbrakes)

As the glider buffets, your instructor will quickly close the airbrakes, and if necessary, ease the stick forward to reduce the angle of attack until the glider regains flying airspeed.

You will then perform a stall and recovery with the airbrakes open on your own. The buffeting will be harder to recognize because of the additional turbulence caused by the airbrakes. To recover, close the airbrakes and lower the nose until the wing is no longer stalled. It is important to recover with minimal loss of altitude, since this type of stall would most likely occur close to the ground.

Common Errors

- Failure to clear the area before intentionally stalling the glider
- Failure to initiate a recovery at the first sign of buffeting
- Failure to close the airbrakes as the first step in the recovery
- Moving the stick too far forward when recovering from the stall, causing excessive airspeed and unnecessary loss of altitude
- Trying to keep the nose of the glider from dropping by pulling back harder on the stick as the glider stalls
- Allowing the nose of the glider to rise above the horizon during the recovery

Completion Standard

This lesson is complete when you can list and recognize the warning signs of a stall, and can recover from a stall that occurs while the airbrakes are open with minimal loss of altitude.

4.15 Side Slip – Correcting for Alignment Errors

Purpose

As the name implies, a side slip is when the glider slips sideways through the air. This maneuver will be practiced at altitude in this lesson, but is normally used to correct for alignment errors when on final approach.

Procedure

During a side slip, the glider is deliberately flown uncoordinated. The wings are held in a bank using the ailerons, and the glider is prevented from turning by using opposite rudder.

During a slip, the side force produced by the fuselage offsets the horizontal component of the lift vector. The more bank angle you use (i.e., the larger the horizontal component of the lift vector), the more rudder you must use. Most gliders are limited in how much they can be slipped by the amount of rudder authority they possess.

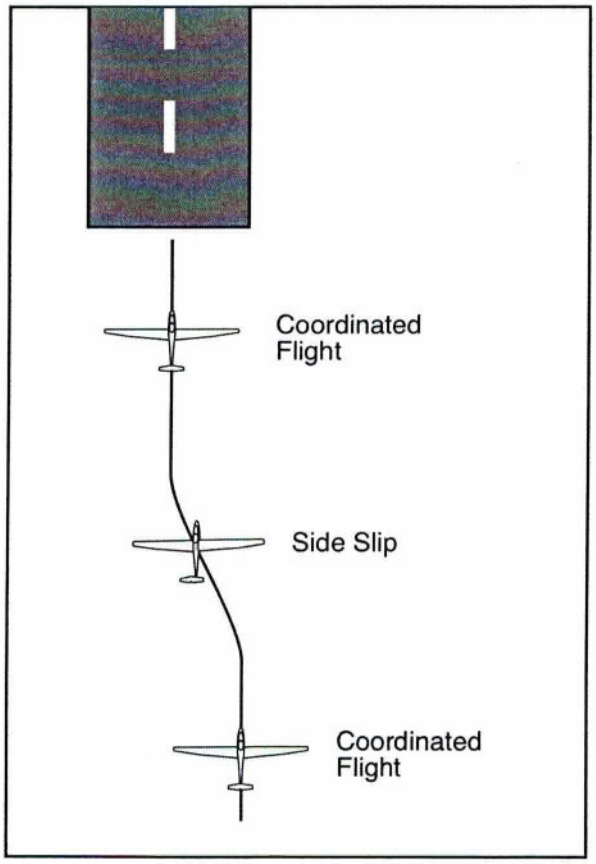


Figure 4.12 – Using a side slip to correct for an alignment error on final

To enter the side slip, use coordinated aileron and rudder to lower the wing in the direction that you want to slip. You must then apply enough opposite rudder to keep the nose from turning. There should be no heading change during this type of slip, but there will be a change in the track of the glider.

Once the alignment error has been corrected, you should remove the slip by using coordinated aileron and rudder. You will have to momentarily bank opposite the direction of the slip to halt the sideways momentum of the glider. To perform a slip to the left, as shown in Figure 4.12, you would lower the left wing, then hold right rudder during the slip. To recover, you would simply bank to the right by bringing the stick to the right to coordinate with the rudder input already applied, and then level the wings with coordinated left aileron and left rudder. The maneuver is simpler to perform than to describe!

Common Errors

- Using too much bank angle, so that the glider turns in the direction of the slip
- Initiating the slip with rudder instead of coordinated aileron and rudder
- Using too much rudder, so that the glider does a skidding turn
- Failure to keep the nose of the glider on the same heading throughout the maneuver

Completion Standard

This lesson is complete when you can enter and recover from a side slip, while maintaining the desired airspeed within +10/–5 knots and maintaining the desired heading within ±10°.

4.16 Side Slip – Compensating for a Crosswind

Purpose

A crab can be used to compensate for a crosswind when at altitude. However, when landing, the glider must be aligned with the runway when it touches down to avoid large side loads being put on the landing gear. This is accomplished by using a side slip. This maneuver will be practiced at altitude in this lesson, but is normally used to compensate for a crosswind when on final approach.

Procedure

A slip used to compensate for a crosswind is entered differently than a slip used to correct for alignment errors. As you learned in the previous lesson, in a slip used to correct for alignment errors, the heading of the glider does not change. However, when you correct for a crosswind on final, you will be transitioning between crabbing flight into slipping flight, and a heading change is required.

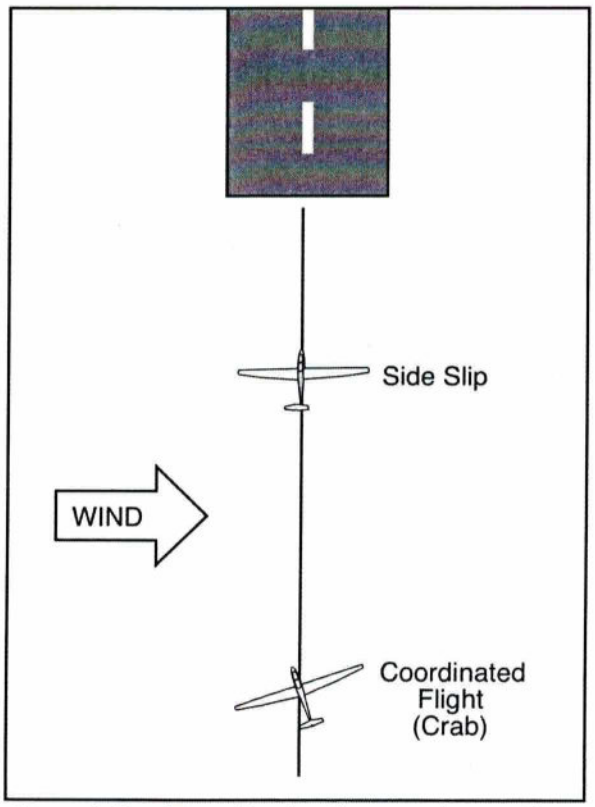


Figure 4.13 – Transitioning from a crab to a slip to compensate for a crosswind when landing

A slip that is used to compensate for a crosswind is not removed before landing, but is held all the way through the touchdown and rollout. (You will learn more about this in Lesson 6.3, Crosswind Landings.)

To enter this type of slip, you use the rudder to hold the glider's fuselage parallel to the runway, and simultaneously use the ailerons to maintain alignment with

the runway centerline. You will most likely need to continually alter the amount of rudder and bank angle as you descend, to adjust for the wind gradient (see Section 5.3).

Since slipping is uncoordinated flight, your drag, and therefore your descent rate, will be higher. You may need to decrease the amount of airbrake to prevent too rapid of a descent rate.

If you perform a significant slip to compensate for the crosswind, you may find that the airspeed indicator reads erratically. This is because air is flowing into the pitot tube at an angle, and the airflow may be separating from the fuselage in the area of the static ports. Most gliders are difficult to stall in a slip. (You should confirm that this is true of the glider you are flying while at a safe altitude.) You should monitor the pitch attitude to keep the airspeed constant.

Common Errors

- Using too much bank angle, so that the glider turns in the direction of the slip
- Using too much rudder, so that the glider does a skidding turn
- Failure to keep the fuselage of the glider parallel to the runway
- Failure to keep the glider over the centerline of the runway

Completion Standard

This lesson is complete when you can compensate for a crosswind using a slip, maintaining a specified heading within ±10°, and maintaining a specified airspeed within +10/– 5 knots.

4.17 Forward Slip

Purpose

In some cases, it may be desirable to have a steeper approach angle than can be obtained using the airbrakes alone. A forward slip significantly increases the drag of the glider, allowing you to steepen the glide slope without increasing your airspeed. A forward slip can also be used in the unlikely event that the airbrakes fail to operate. In this lesson, you will practice entering and recovering from a forward slip at altitude.

Procedure

You enter a forward slip in the same way you would transition from a crab to a side slip to compensate for a crosswind. During the initiation of both types of slip, the glider changes its heading but not its track.

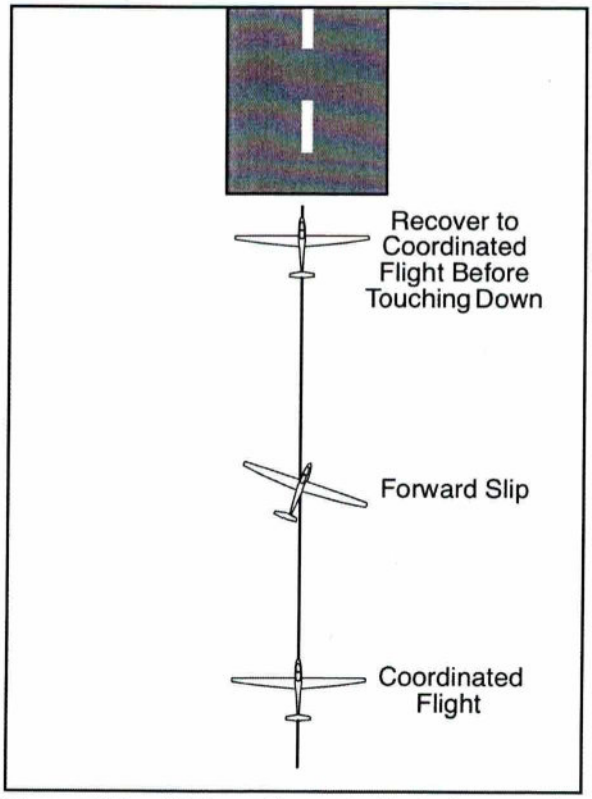


Figure 4.14 – Using a forward slip to increase the glider's sink rate on final

To enter a forward slip, smoothly apply the ailerons and opposite rudder. You control the sink rate with the rudder, while using the ailerons to maintain the desired track. If there is any crosswind, you should lower the upwind wing when starting the forward slip.

To recover from the forward slip, simply neutralize the controls. The nose of the glider may have a tendency to swing past the desired position during the

recovery, so be ready to apply opposite rudder to stop the nose when the nose is pointing on the desired heading and the yaw string is straight.

In some gliders, the rudder forces will reverse in an extreme slip (i.e., the rudder will not return to neutral on its own). If this happens, you will have to force the rudder back to neutral to end the slip.

As with other slips, monitor the pitch attitude carefully, since the airspeed indicator is rarely accurate in any significant forward slip.

This maneuver can use up a lot of altitude quickly. Keep a close eye on your altitude when practicing forward slips and always make sure you will have enough altitude to make it back to the airport.

Common Errors

- Using more bank angle than can be countered by the rudder
- Failure to maintain a constant pitch attitude during the forward slip

Completion Standard

This lesson is complete when you can use a forward slip to adjust your glide slope, maintaining a specified heading within ±10°, and maintaining a specified airspeed within +10/–5 knots.

4.18 Low-G Maneuvers

Purpose

Some students are confused by low-G sensations into thinking that the glider is stalled, when in fact it is flying normally, well below the critical angle of attack. If you incorrectly believe that the falling sensation you feel is caused by a stall, you may move the stick forward, making the sensation worse. In this lesson, you will learn to distinguish between the falling sensation of a stall and the low-G sensations resulting from normal maneuvering.

Procedure

You will be changing altitude rapidly during this maneuver, so be sure to clear the area both above, below, and to the sides before starting. Once you have cleared the area, point the nose of the glider about 30° below the horizon until the glider reaches an airspeed of about 80 knots (but no faster than the maneuvering speed). Smoothly but quickly raise the nose to 45° above the horizon, and then smoothly but firmly move the stick forward so that you get a "floating" sensation.

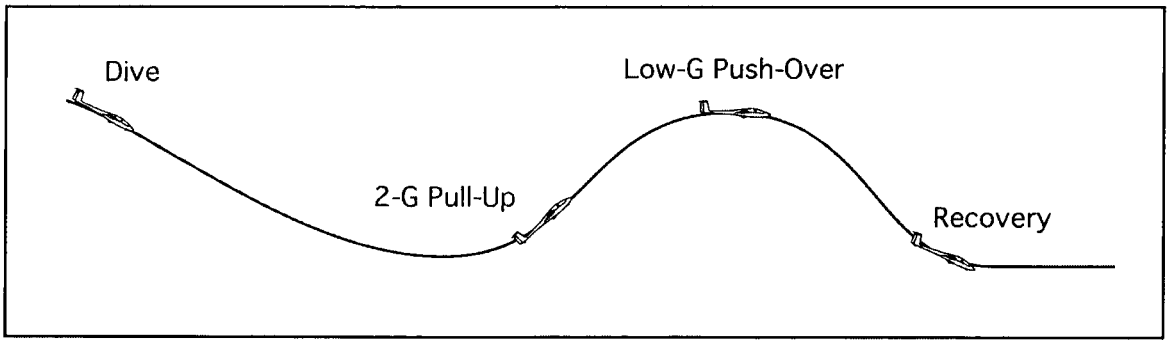


Figure 4.15 – Reduced G-forces from maneuvering should not be confused with the falling sensation experienced when stalled.

Notice that most of the warning signs of a stall are NOT present during this floating or falling sensation. The stick is not back, the nose is not rising, the controls are not mushy, and there is no buffeting.

Common Errors

- Exceeding the maneuvering speed for your glider in the dive
- Initiating stall recovery procedures during low-G maneuvering

Completion Standard

This lesson is complete when you can distinguish between a stall and normal low-G maneuvers.

4.19 Selecting a Cruise Airspeed

Purpose

The airspeed at which you fly the glider has a significant impact on its performance. In this lesson, you will learn how to select the proper speed to fly for the conditions.

Procedure

Your objectives will have a major influence on the airspeed at which you should fly. You can choose to maximize either your speed on course, your time aloft, or your glide distance over the ground.

Maximizing the speed on course is explained in Chapter 15: Cross-Country, in the *Glider Pilot's Handbook of Aeronautical Knowledge.*

If your goal is simply to stay in the air as long as possible, you should fly at the minimum sink airspeed, and avoid sinking air.

However, in order to cover the most distance from a given altitude, you must constantly adjust the airspeed of the glider to account for both horizontal and vertical movement of the air. In the remainder of this lesson, we will assume that you are trying to select the airspeed that will maximize your glide distance over the ground.

The first step in deciding on the speed to fly is to determine whether there is a tailwind or a headwind. There are several ways to determine the wind speed and direction. You could rely on weather forecasts or reports, you could assume that the wind is the same as it was on the ground when you launched, or you could estimate the wind speed and direction based on the amount of drift you experience when circling in thermals, or the amount of crab angle required in a crosswind. Keep in mind that it is usually safer to slightly overestimate a headwind than it is to underestimate it. Usually, the wind speed will increase with increasing altitude.

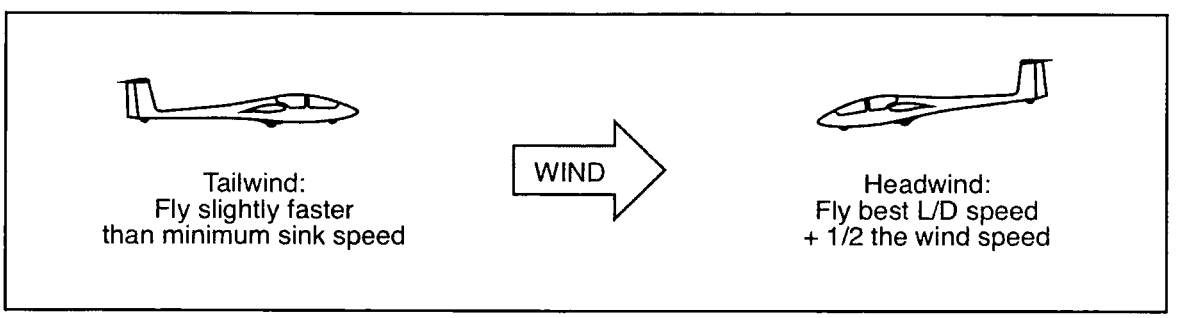


Figure 4.16 – Rules of thumb for speeds to fly in a tailwind or headwind

To cover the most ground when flying into a headwind, you should fly faster than the best L/D airspeed for the glider. The exact airspeed can be obtained from the glider polar, but a good rule of thumb is to add half of the headwind

component to the best L/D airspeed for the glider. For example, if your best L/D airspeed is 55 knots and you are flying into a 20-knot headwind, you would fly 65 knots to cover the most ground.

If you have a tailwind, you will want to fly slower than the best L/D airspeed. Once again, the exact figure can be obtained from the polar based on the wind speed, but in general, you should fly slightly faster than the minimum sink airspeed.

Correcting for Sink/Lift

If the air mass that you are in is rising, you should slow down to minimum sink airspeed, so that you stay in the air mass as long as possible and climb as quickly as possible. On the other hand, if you are in sinking air, you should speed up, so that you spend as little time as possible in the air mass.

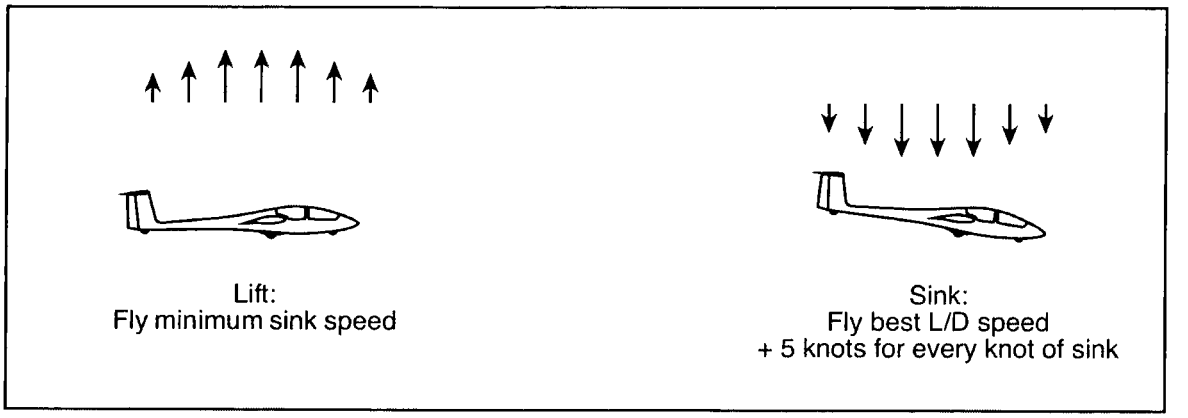


Figure 4.17 – Rules of thumb for speeds to fly in lift or sink

Once again, the exact airspeed for a given sink rate can be determined from the glider polar, but a good rule of thumb is to speed up 5 knots above the best L/D airspeed for every knot of sink. For example, if you are flying at the best L/D airspeed for your glider of 50 knots, and your sink rate is normally 2 knots at this airspeed, but the variometer is indicating 6 knots down (assuming your variometer is not NETTO compensated), you should speed up 20 knots, (6 - 2) x 5, to 70 knots, until your are clear of the sink.

Be careful not to "chase the vario" into the ground. As you speed up to the proper speed to fly, the variometer will naturally indicate an increase in the sink rate because of the increased airspeed. It is usually not necessary to fly more than about 20 knots faster than the best L/D airspeed, and usually only for a few seconds at a time.

Using a Speed Ring

Since few pilots carry their glider's polar with them in the cockpit, a device was invented to help the pilot determine the best speed to fly for the current lift or sink conditions. This device is called a speed ring (or sometimes a McCready speed ring, after its inventor). It consists of a dial that can be rotated around the

variometer face. The dial is marked with airspeeds. When the triangle on the ring lines up with the zero on the vario, the needle of the vario will point to the best airspeed to fly to cover the most distance in *no wind*.

Figure 4.18 – A speed ring indicating a speed to fly of 62 knots

The speed ring shown in Figure 4.17 indicates that the glider should be flown at about 62 knots to achieve the best glide distance. If the sink were to increase from the current 2.8 knots to 6 knots, the speed to fly would increase to about 76 knots.

The speed ring only takes into account lift and sink. Corrections for wind speed must be applied to the speed ring values.

Common Errors

- Flying too fast when within easy glide of the airport in calm air, when the minimum sink speed would give a longer flight
- Flying too slowly through sink, causing significant altitude loss
- Failure to fly at minimum sink airspeed when in lift
- Failure to notice when the conditions, and therefore the desired cruise airspeed, have changed

Completion Standard

This lesson is complete when you can select the optimum airspeed for the conditions, and can maintain that airspeed within ±5 knots.

4.20 Deep Stall Recognition and Recovery

Purpose

If you do not react properly to an impending stall, or the glider is handled too abruptly or hits severe turbulence when flying slowly, a deep stall can occur. In this lesson, you will learn to recognize and recover from a deep stall.

Procedure

When a glider is in a deep stall, the angle of attack is well above the critical angle of attack, and the airspeed is extremely low. The forward speed is so low that simply recovering to a "normal" pitch attitude will not be sufficient to end the stall. To recover from a deep stall, you must lower the glider's nose well below the horizon to attain sufficient airspeed before attempting to raise the nose to a more normal attitude. If you try to raise the nose before gaining sufficient airspeed, the glider will remain stalled.

After clearing the area for traffic, your instructor will demonstrate the procedure for initiating a deep stall by raising the nose of the glider about 45-60° above the horizon. The airspeed will decay rapidly, and the glider will seem to "come to a stop" as it loses momentum. As it stalls, the nose of the glider will drop sharply. Your instructor will keep the nose well below the horizon and allow the glider to pick up flying speed before raising the nose to a normal pitch attitude.

When it is your turn, you should again thoroughly clear the area. Starting at an airspeed of 60-70 knots, you should smoothly but quickly raise the nose 45-60° above the horizon and hold it there. As the glider stalls and the nose of the glider drops, ease the stick to a position slightly forward of neutral. The nose will drop almost violently. Wait for the airspeed to build up to normal flying speed before recovering to a normal pitch attitude. As you recover, be alert for a secondary stall. If the glider buffets, you should again lower the nose and wait for the airspeed to increase.

Common Errors

- Failure to clear the area before intentionally stalling the glider
- Trying to keep the nose from dropping by using back stick after the stall
- Failure to allow the airspeed to increase before attempting to return the glider to normal pitch attitude
- Allowing the nose to rise above the horizon during the recovery
- Allowing excess build-up of airspeed

Completion Standard

This lesson is complete when you can recover from a deep stall with minimal loss of altitude.

4.21 Chandelle

Purpose

The chandelle is a steep climbing turn. It is used by glider pilots to transition between cruising and thermaling flight.

When you cruise between thermals, it is often best to fly at an airspeed significantly higher than the minimum sink airspeed. When you encounter lift while flying at high speed, however, it is important to get the glider slowed down and turning as quickly as possible so that you do not lose the thermal. In this lesson, you will learn how to perform a chandelle, which will end with the glider circling at the minimum sink airspeed.

Procedure

The chandelle consists of a pull-up from high-speed cruise into a steep-climbing turn. As the glider loses airspeed, the bank angle is reduced to about 45°, and the nose is lowered to an appropriate pitch attitude. The glider will then be positioned above where the maneuver was started, ready to work the thermal.

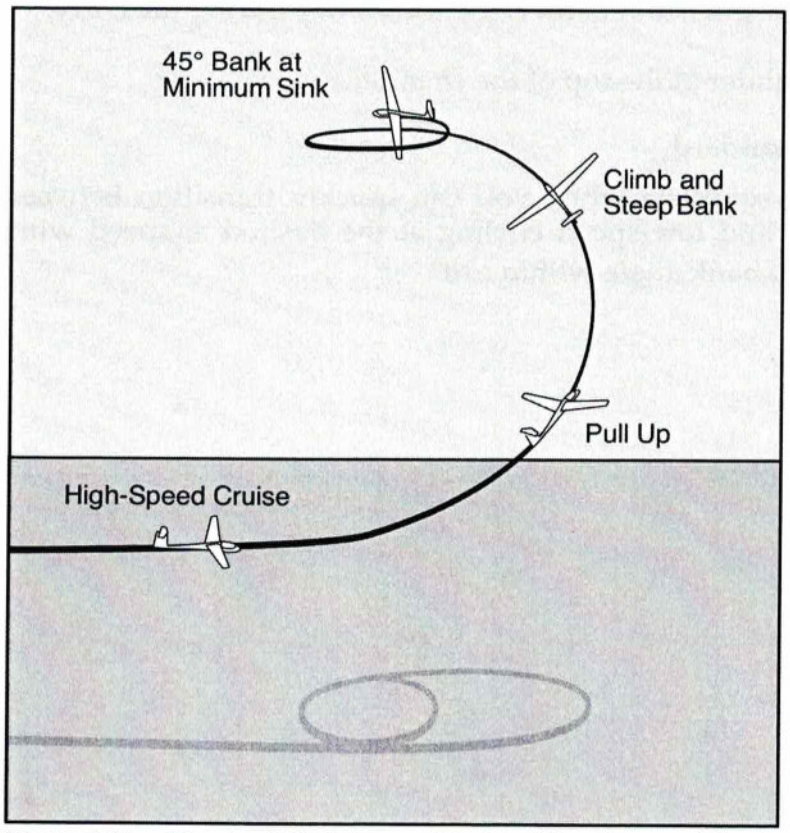


Figure 4.19 – The chandelle being used to transition from cruising to thermaling flight

Since the chandelle involves a significant pitch up along with an increase in altitude, it is critical that you check for traffic above you and to both sides before beginning the maneuver.

To practice the chandelle, you should establish a cruising airspeed of at least 80 knots, but not greater than the maneuvering speed of the glider. When signaled by your instructor, you should quickly clear for traffic and then abruptly enter a climbing turn.

In order to stay as close as possible to the thermal (or the starting point of the maneuver), you should pitch the glider nose up and into a steep bank. As the airspeed drops, you should reduce the bank and pitch angle so that the glider is at a 45° bank angle just as the airspeed drops to the minimum sink airspeed. With practice, you should be able to quickly transition between high-speed cruising flight and low-speed circling.

Common Errors

- Failure to clear the area before starting the turn
- Increasing the pitch and bank angle too slowly during the entry
- Stalling the glider at the top of the chandelle

Completion Standard

This lesson is complete when you can quickly transition between high-speed cruising flight and low-speed circling at the desired airspeed within ±10 knots and the desired bank angle within ±10°.

4.22 Incipient Spin Recognition and Recovery

Purpose

If an unintentional spin should occur near the ground, you must react very quickly to recover. In this lesson, you will learn to recognize the events leading to a spin, and to recognize and recover from an incipient spin.

Procedure

A spin is the result of one wing's being more stalled than the other. Any time the glider is stalled, a spin can develop, especially if the glider is being flown uncoordinated.

An unintentional spin at low altitude is one of the most common causes of fatal aircraft accidents. The typical spin occurs when a pilot gets too low, forces the glider to turn with the rudder (skids), flies too slowly, and thus causes the glider to stall. This might happen when the stress of being low distracts the pilot from the most important task at hand: flying the glider.

Avoiding a stall/spin accident requires knowing the warning signs of a stall, recognizing that the conditions for a spin are developing, and reacting quickly and correctly to recover.

For a glider to spin, it must be stalled. By now, you should know that the warning signs of a stall are:

- Stick back
- Nose rising
- Decreasing airspeed
- Decreasing wind noise
- Mushy controls
- Buffeting

If you are using rudder to force the glider to turn (skidding), the natural stability of the glider (resulting from the dihedral in the wings) will cause the glider to roll in the direction of the turn. If you resist this rolling moment with the ailerons, you will increase the angle of attack on the inside wing tip, possibly causing it to stall, producing a spin.

The best way to avoid a spin accident is to avoid the situations that lead to spins when you are near the ground. Do not fly slowly in rough thermals or ridge lift while close to terrain. Do not allow yourself to get too low to fly a normal pattern, whether you are landing at an airport or in a field. Do not get distracted

from your primary responsibility of controlling the glider. Do not use the rudder to force the glider to turn.

You will practice recognizing and recovering from incipient spins while at a safe altitude. You should be high enough so that you will be at least 1,500 feet above the ground after you recover.

As for any stalling maneuver, the first step to practicing incipient spin entry and recovery is to clear the area. Next, you will enter a shallow, nose-high, skidding turn. As you continue the turn, the glider will try to over-bank. You should try to hold the wings at the desired shallow bank angle using the ailerons as long as the wings are not stalled. (Once a stall occurs, it is critical that you return the ailerons to neutral, because having them deflected will make the spin worse.)

When the glider buffets, it will also likely try to drop the inside wing. Do NOT try to pick up the stalled wing with the ailerons or you can make the spin worse by increasing the angle of attack on the inside wing. Instead, neutralize the ailerons and apply full opposite rudder until any rotation stops, and move the stick forward to lower the angle of attack. Once you have regained flying speed, smoothly recover to level flight.

NOTE: Some gliders may require a different recovery technique. Make sure that you are familiar with the recovery technique prescribed in your glider's flight manual.

Remember that the purpose of this lesson is for you to learn to recognize, and quickly and correctly react to an incipient spin. Do not allow the spin to develop fully; start your recovery as soon as you feel the glider starting to stall or spin.

Common Errors

- Failure to clear for traffic before starting the maneuver
- Starting the maneuver too low to maintain 1,500 feet AGL after the recovery
- Failure to maintain a constant bank angle before the glider stalls
- Failure to immediately recover at the first signs of a spin
- Attempting to raise a stalled wing with the ailerons
- Failure to neutralize the rudder once the rotation has stopped
- Moving the stick too far forward when recovering, causing excessive airspeed and unnecessary loss of altitude

Completion Standard

This lesson is complete when you can explain the events leading to a spin, and can consistently recognize and recover from an incipient spin.

4.23 Spin Recognition and Recovery

Purpose

In the previous lesson, you learned how to recognize and react to an incipient spin without allowing the spin to fully develop. A full spin can be very disorienting the first time you encounter one. In this lesson, you will learn what it feels like to be in a fully developed spin and how to recover from the spin.

Procedure

To practice spins and spin recovery, you must use a glider that is both capable of and certified for spins. Your instructor will probably introduce you to the use of a parachute and go over the procedure for jettisoning the canopy, removing your belts, exiting the glider, and deploying the parachute before you go up for this lesson.

As for any stalling maneuver, the first step to practicing spin entry and recovery is to check the area for traffic. You will then enter a shallow, nose-high, skidding turn, while at an altitude of at least 3,000 feet AGL. As you continue the turn, the glider will tend to over-bank. You should try to hold the wings at the desired shallow bank angle using the ailerons as long as the wings are not stalled. As the glider approaches a stall (if you don't know the warning signs by now, you're grounded!), you should continue to pull back on the stick and apply full rudder in the direction of the turn. The glider should enter a full spin at this point.

As long as you hold the stick all the way back and the rudder in the direction of the spin, the glider should continue to spin. While in the spin, note that the noise is relatively low, the G-forces are mild, and the airspeed is low. This differs greatly from a spiral dive, in which there is significant wind noise, high G-forces, and increasing airspeed. Some gliders will recover from a spin on their own. If the glider transitions from a spin to a spiral dive, you should level the wings and then bring the nose of the glider to a normal pitch attitude.

To recover from the spin, apply full opposite rudder, neutralize the ailerons, and move the stick forward to lower the angle of attack until the rotation stops. Once you have regained flying airspeed, smoothly recover to level flight.

In a fully developed spin, the glider may be in an extremely nose-down attitude. This makes it important that you monitor the airspeed carefully during the recovery so as not to over-speed or over-stress the glider.

NOTE: Some gliders may require a different recovery technique. Make sure that you are familiar with the recovery technique prescribed in your glider's flight manual.

Common Errors

- Not clearing the area before starting the maneuver
- Starting the maneuver too low
- Attempting to raise a stalled wing with the ailerons
- Failure to neutralize the rudder once the rotation has stopped
- Allowing excessive airspeed and unnecessary loss of altitude during the recovery

Completion Standard

This lesson is complete when you can explain the difference between a spiral dive and a spin, and can recover from a full spin with minimal loss of altitude while keeping the airspeed below the maneuvering speed of the glider.

4.24 Rapid Speed Changes

Purpose

During a single flight, your desired airspeed to fly will change depending on the wind, lift, sink, etc. In this lesson, you will practice quickly and efficiently changing the airspeed and trimming the glider.

Procedure

Your instructor will specify an airspeed for you to fly. You should quickly adjust the pitch attitude to achieve the airspeed and trim the glider so that it will fly hands-off. Your instructor will then give you another airspeed to fly, and you will quickly adjust the pitch and trim for the new airspeed.

For large airspeed changes, you can overshoot the pitch at first to quickly gain/lose airspeed, and then as the glider approaches the desired airspeed, establish a pitch attitude appropriate to the airspeed. For example, if you are flying at 90 knots and want to slow down to 50, you can bring the nose well above the horizon until the airspeed has dropped to around 70, and then lower the nose to the level corresponding to 50 knots. With practice, you should be able to quickly hit a target airspeed without too many secondary adjustments.

Common Errors

- Failure to maintain a constant pitch attitude while trying to hold a constant airspeed

- Failure to attain and trim for the new target airspeed within a short period of time

Completion Standard

This lesson is complete when you can quickly adjust the pitch and trim to achieve a target airspeed within ±5 knots.

4.25 High-Speed Flight

Purpose

The glider handles different at high airspeeds than at normal airspeeds. The controls take more force to move, adverse yaw is less pronounced, and the glider is more responsive. In this lesson, you will fly the glider between the maneuvering speed and the never-exceed speed (redline) to learn how it behaves.

Procedure

To go fast, you need to put the nose down. Be careful not to fly within 10 knots of the never-exceed speed of the glider, and not to use any more than one-third of full control deflection when going faster than the maneuvering speed. Try turning the glider at high airspeeds and notice how almost no rudder is needed to compensate for adverse yaw. Recover to normal airspeed. That was easy!

Common Errors

- Allowing the glider to accelerate to within 10 knots of its never-exceed (redline) speed
- Using too much rudder during turns
- Using too much control movement when exceeding the maneuvering speed

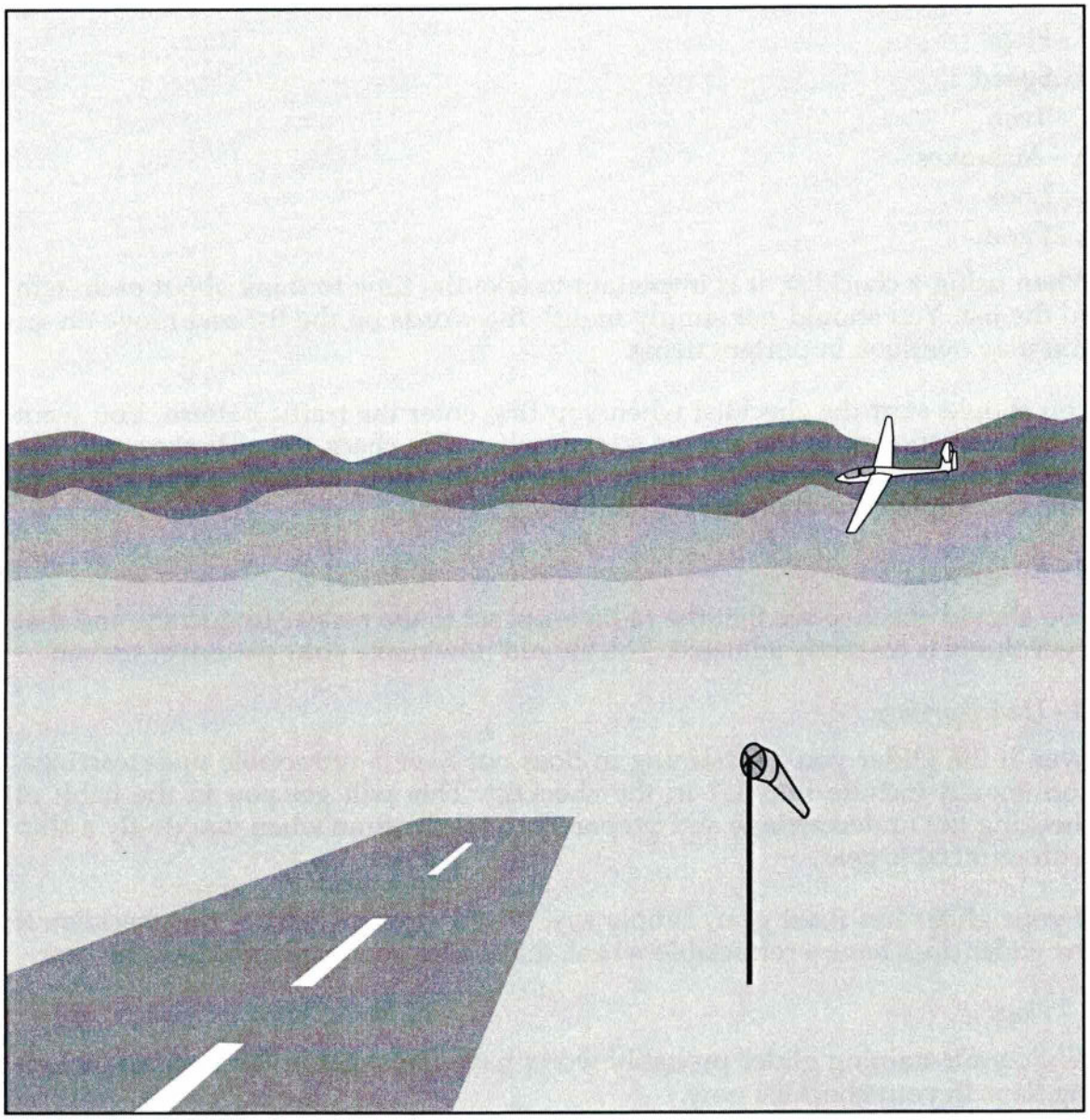
Completion Standard

This lesson is complete when you are able to use smooth and coordinated control movements to maneuver the glider at airspeeds between the maneuvering speed and the never-exceed speed.

CHAPTER 5: LANDING PATTERNS

The landing pattern serves various functions. It provides a transition into the airport environment, allowing for the smooth flow of traffic; it allows you time to examine the landing field to check for wind and obstacles on the ground; and it helps you to achieve a precise, smooth landing.

In this chapter, you will be introduced to the landing pattern, and you will learn to fly different types of patterns under various conditions.



5.1 Landing Checklist

Purpose

A checklist is used to ensure that the glider is in the proper configuration for landing. In this lesson, you will memorize the pre-landing checklist and practice performing it before each landing.

Procedure

The acronym "RUFSTALL" will help you to remember the landing checklist. You should commit the checklist to memory.

R - Radio
U - Undercarriage
F - Flaps
S - Speed
T - Trim
A - Airbrakes
L - Look
L - Land

When using a checklist, it is important to take the time to think about each item on the list. You should not simply mouth the words on the list and move on, or you may overlook important items.

You should start the checklist when you first enter the traffic pattern. You want to be close enough to the airport so that when you check the airbrakes, you can make it to the runway if they fail to close, but far enough away so that you have time to complete the checklist without being rushed.

R - Radio

You should check to see that the radio is on, set to the proper frequency, and that the volume is correctly adjusted. You should now make your pattern entry call.

U - Undercarriage

Even if the glider you are training in does not have a retractable undercarriage, you should include the "U" in the checklist. This will get you in the habit of checking the undercarriage and prepare you for the time when you do fly a ship with retractable gear.

If your glider has fixed gear, simply say, "fixed" for this part of the checklist. If the glider does have a retractable wheel, make sure you lower and lock the gear.

F - Flaps

While your training glider probably won't have flaps, get in the habit of including flaps in your checklist now.

If your glider does not have flaps, simply say, "fixed" for this part of the checklist. If your glider does have flaps, make sure they are properly configured for landing.

S - Speed

Decide what airspeed you will fly in the pattern. This should be the best glide speed for the glider, plus half the wind speed, plus half the maximum gust speed. For instance, if you have a 10-knot wind gusting to 20, you would add 5 knots for the wind and 5 knots for the gustiness. Call the speed that you have decided on aloud so that your instructor knows what speed you are aiming for.

T - Trim

Set the trim so that the glider will maintain the airspeed you decided on even if you take your hands off the stick.

A - Airbrakes

Open the airbrakes fully and confirm that they are operating normally, and then close them until you need them.

L - Look

Look for three things: traffic, wind, and obstacles. Look for traffic in the pattern. Look for the wind conditions on the ground. (Is the wind still from the expected direction? Is there gustiness?) Finally, look for obstacles on the ground, such as aircraft, people, or animals on the runway, or airplanes taxiing into position that might be a factor if they were to cut in front of you.

L - Land

Most people don't forget to do this one, but it makes the acronym look better! So for "land," let's just say land safely and gracefully.

Once you have committed the checklist to memory, you should use it each time you enter the pattern, calling out each item in the list as you attend to it.

Common Errors

- Not starting the checklist early enough
- Failure to perform the checklist
- Skipping items due to distractions
- Failure to fly the glider while performing the checklist

Completion Standard

This lesson is complete when you have memorized the RUFSTALL checklist and use it before every landing.

5.2 Introduction to the Landing Pattern

Purpose

A landing pattern provides for an orderly entry into the airport and gives you time to familiarize yourself with the airport and conditions. In this lesson, you will learn how to fly the landing pattern using the stick and rudder, while your instructor controls the airbrakes.

Procedure

The Pattern

There are four "legs" to the pattern: the crosswind, the downwind, the base, and the final. A left pattern is one in which all turns are to the left, as shown in Figure 5.1, and a right pattern is one in which all turns are to the right. Unless otherwise specified, a left pattern is standard.

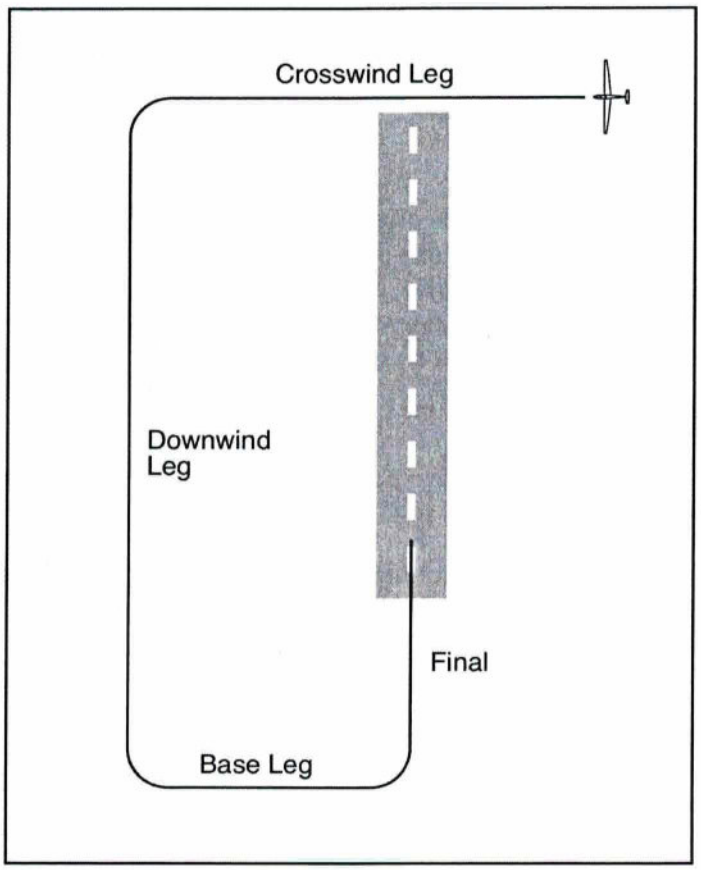


Figure 5.1 – The basic landing pattern

When entering the pattern, you should perform the pre-landing checklist you learned in the previous lesson. Most gliderports use an initial point (IP) as the beginning of the pattern. You should have between 800 and 1,500 feet of altitude AGL when you reach the IP. Your instructor will tell you the desired pattern entry altitude for your airport.

There are different ways to enter the pattern, though for the most part, you will be using either a crosswind, downwind, or "45" entry, as shown in Figure 5.2.

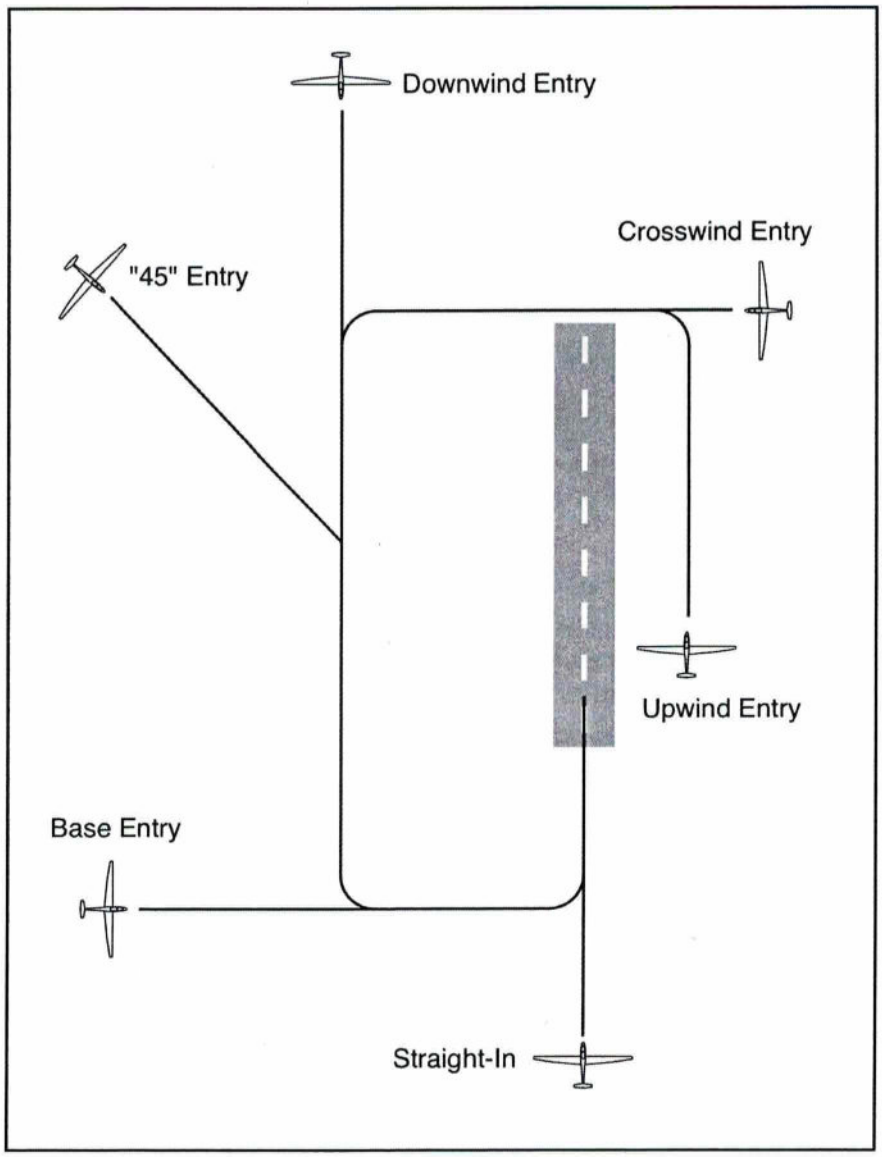


Figure 5.2 – Pattern entry options

A crosswind or upwind entry gives you the best view of the airport. You should only use a base entry or a straight-in approach if you do not have enough altitude for a normal pattern.

The Downwind Leg

You should turn from your crosswind leg (or from your 45 entry) onto your downwind leg when the runway centerline, or an extension of it, is 25-30° below the horizon. Using angles automatically compensates for variations in altitude. If you are high, you will turn downwind further from the runway, and therefore

fly a larger pattern; if you are low, you will turn closer in, flying a smaller pattern.

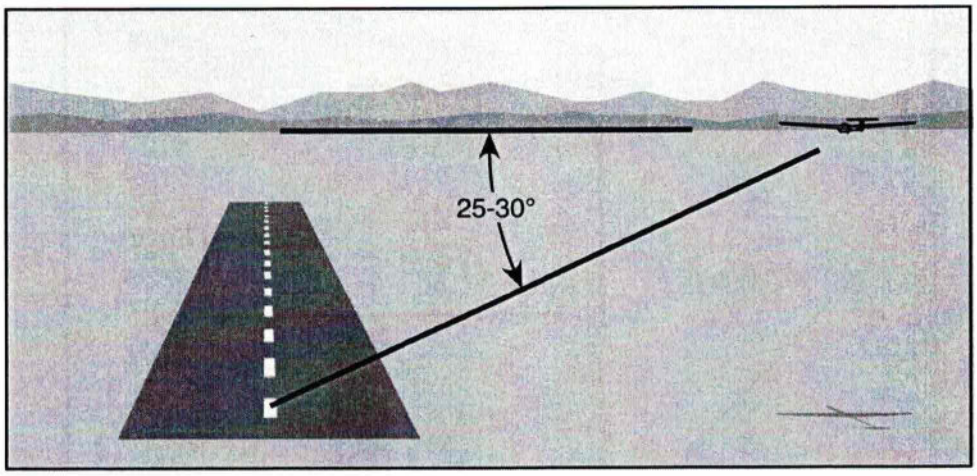


Figure 5.3 – The runway centerline should appear 25-30° below the horizon when you are on your downwind leg.

You can practice visualizing this angle by sighting to a line on the ground, such as a sidewalk. A 25 to 30° angle will place you twice as far away from your target as you are above it. Since most people cover about half of their height in one stride (a large step), if you take four strides away from the sidewalk and then look back at it, it will appear about 30° below the horizon.

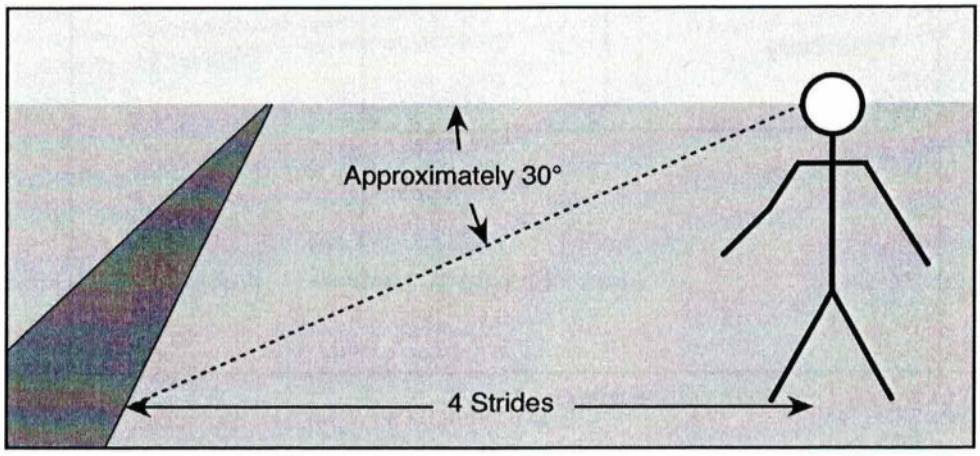


Figure 5.4 – Visualizing a 30° angle

The Stop, Touchdown, and Aim Points

While you are on your downwind leg, you should determine where on the runway you would like the glider to stop. About 500 feet before the stop point will be the touchdown point, and another 500 feet before that will be your aim point.

The actual distances will be determined based on experience, the type of glider, and the existing wind, slope, and altitude at the airport. A headwind will

decrease the distance between the stop, touchdown, and aim points, as will an up-slope on the runway. High elevations, a tailwind, or a down-slope on the runway will require greater distances between the points.

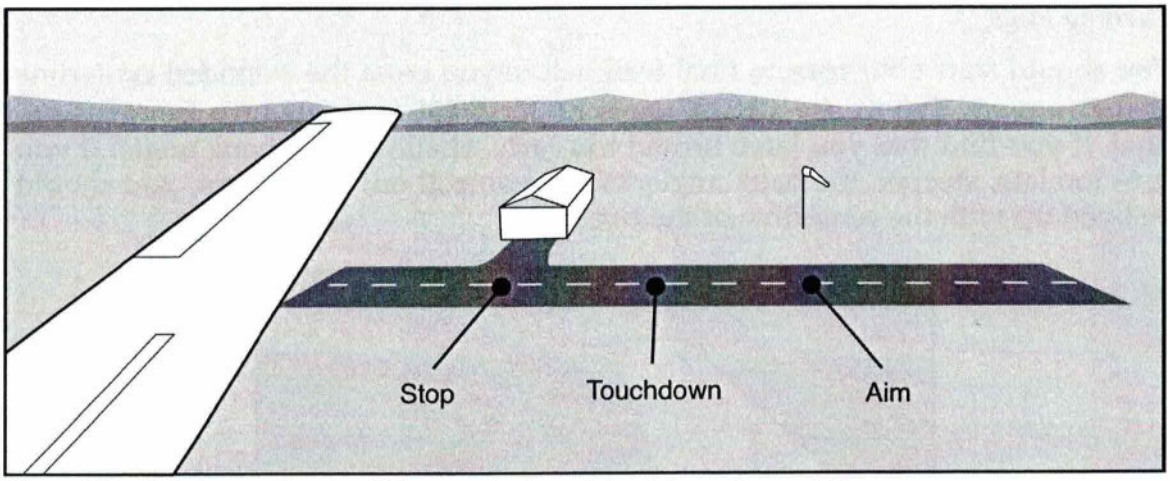


Figure 5.5 – Select your stop, touchdown, and aim points while on downwind.

In Figure 5.5, imagine that you want the glider to stop in front of the hangar. Your touchdown point will be about 500 feet before the hangar, and your aim point will be 500 feet before that, abeam the windsock. Notice that if you use the end of the runway as your aim point, you would probably come to a stop well before the hangar.

The Base Leg

You should turn onto your base leg when your aim point is 45° behind you. If the winds are strong, you will need to reduce this angle. In very strong winds, you will want to turn base just after you past your aim point.

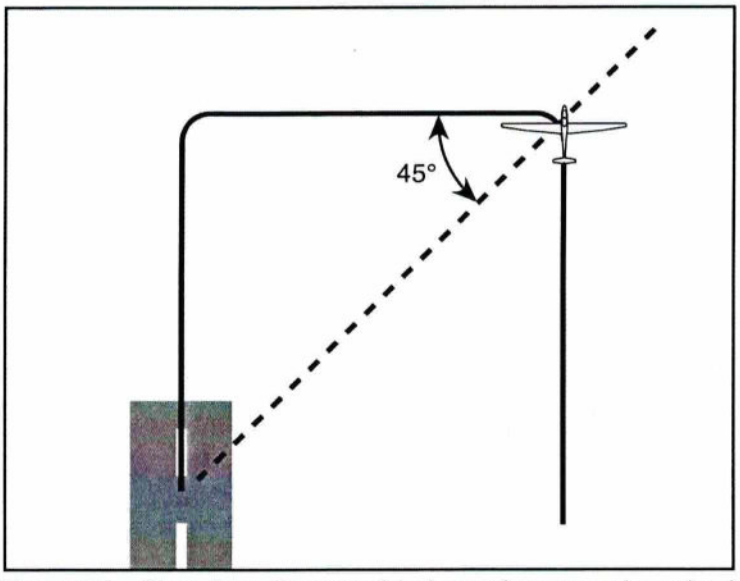


Figure 5.6 – Turn from downwind to base when your aim point is about 45° behind the glider.

Once you have turned base, your instructor will start to use the airbrakes to adjust your glide slope, while you make sure your airspeed stays constant by using pitch control.

Turning Final

You should start your turn to final well before you cross the extended centerline of the runway. Try to use a bank angle of 30 to 45° for your turn from base to final. If you find that you have turned too early, shallow your bank angle. If you turn too late, steepen the bank angle. When you roll out of the turn, you should be lined up with the centerline of the runway.

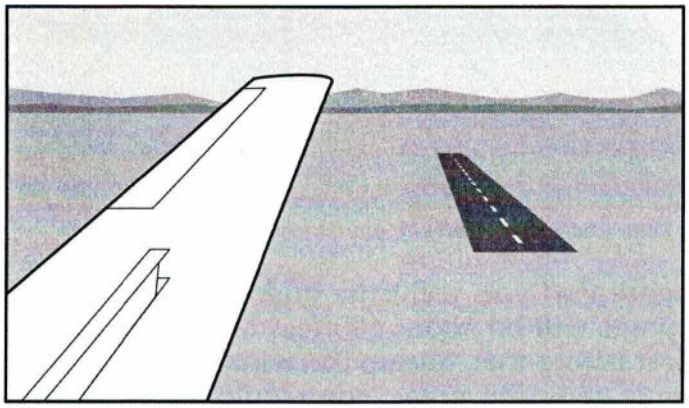


Figure 5.7 – Start your turn to final before you are lined up with the runway centerline. Use a 30-45° bank angle for the turn from base to final.

Once you are on final, concentrate on keeping your airspeed constant and staying lined up with the centerline of the runway while your instructor controls your glide path using the airbrakes.

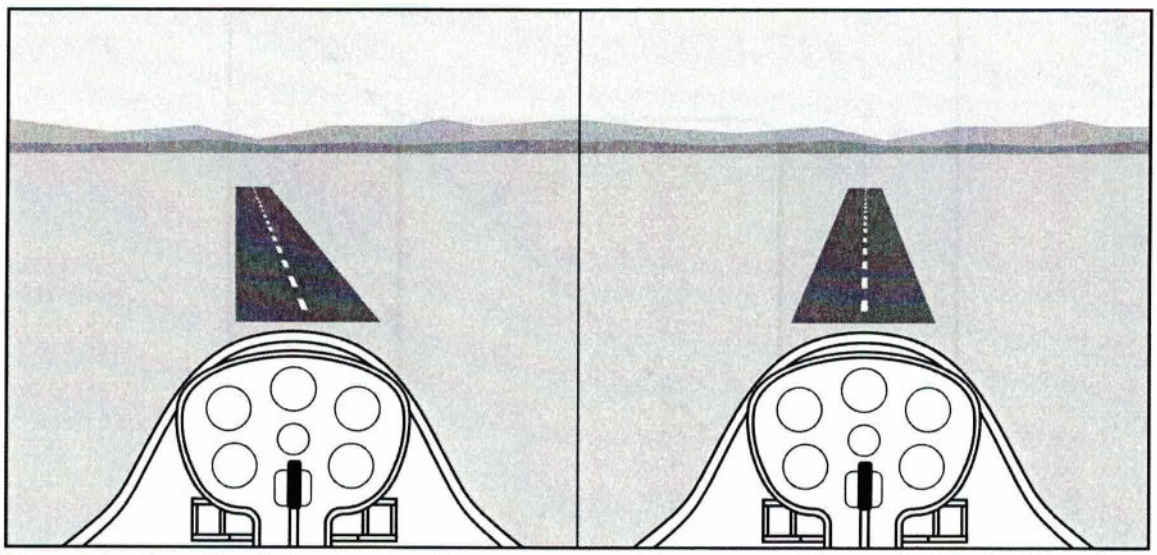


Figure 5.8 – Keep the glider aligned with the centerline of the runway while on final. Both gliders in the figure are heading directly for the end of the runway, but the glider on the left is not aligned with the centerline.

Notice how in Figure 5.8 both gliders are heading towards the end of the runway. However, the glider on the left is off to the left of the centerline. The pilot of this glider will have to make a turn to the left close to the ground to be aligned with the centerline. To the pilot of the glider on the right, notice that the centerline of the runway appears vertical; this indicates that the glider is perfectly aligned.

When you are able to maintain precise control of the glider throughout the final approach, your instructor will have you perform the flare and landing, which are covered in Chapter 6: Landings.

Common Errors

- Entering the pattern too low
- Failure to maintain a 25 to 30° angle to the runway centerline while on downwind
- Turning base too late or early
- Turning final too late or early
- Failure to maintain a constant airspeed
- Failure to maintain alignment with the runway centerline

Completion Standard

This lesson is complete when you can identify each part of the pattern, explain the benefits of flying a pattern, and can enter and fly the pattern maintaining a specified airspeed within +10/–5 knots.

5.3 Glide Slope Control Using the Airbrakes

Purpose

Modern gliders are so efficient that it would be hard to land them precisely if there were not a way to create more drag to steepen the glide slope. In this lesson, you will learn to use the airbrakes to regulate your descent rate so that you arrive at your aim point at the correct altitude and airspeed.

Procedure

Airbrakes steepen the glide slope by increasing the drag. With the airbrakes fully deployed, the glide slope can be as low as 5:1.

You will have the largest safety margin to cope with lift, sink, a headwind, or a tailwind on final if you have the airbrakes halfway deployed. This way, if you get too low, you can close them, and if you are too high, you can open them further. Your goal is to arrive at your aim point at your pattern airspeed with the airbrakes halfway open.

When you turn from downwind to base, you should assess your situation: are you high, low, or about right? If you are about right, or if you can't make up your mind, open your airbrakes halfway. If you are clearly too low, leave the airbrakes closed. If you are too high, open the airbrakes all the way. Your instructor will help guide you as to the appropriate amount of airbrake to use.

As you turn from base to final, you should again assess your glide slope. If half airbrakes will bring you to your aim point, then that is where you should set them. However, if half airbrakes will cause you to undershoot, you should close them completely until you intercept the half-airbrake glide slope. Likewise, if you are too high, you should open the airbrakes fully until you intersect the half-airbrake glide slope, and then set them at the half-open position.

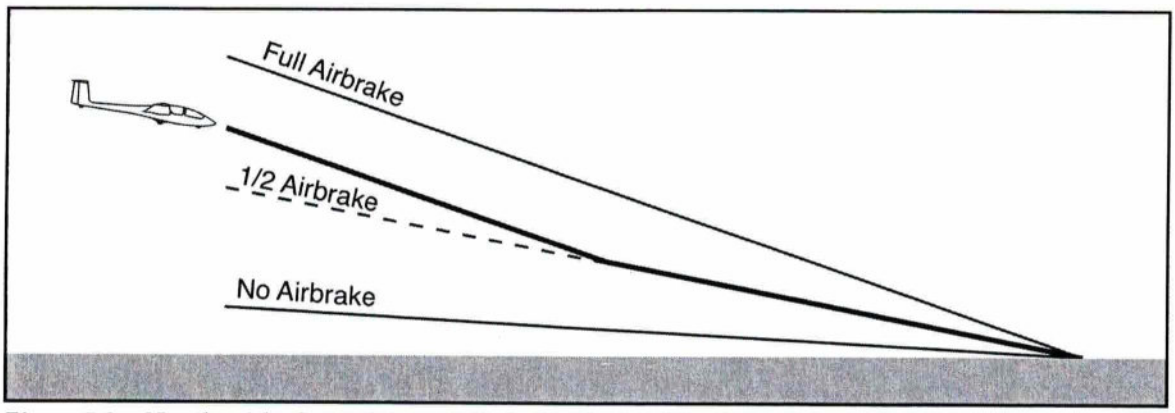


Figure 5.9 – Use the airbrakes to intercept the half-airbrake glide slope.

In Figure 5.9, the pilot is too high on final and recognizes that using only half airbrakes will not be sufficient to make it to the aim point. The pilot could open the airbrakes three-quarters of the way, but this would mean that on short final, a vertical gust, a decrease in headwind, or an increase in tailwind could cause the

glider to overshoot the aim point. Instead, the pilot should open the airbrakes all the way, until the glider intercepts the half-airbrake glide slope.

If your aim point appears to be moving up relative to the nose of the glider, you are undershooting and need to close your airbrakes. If your aim point appears to be moving down, you are overshooting and need to open the airbrakes.

Open and close the airbrakes smoothly. Don't be too quick to readjust the airbrakes. It will take some time for the adjustment to take effect and be noticeable.

As you get closer to the ground, you should have the airbrakes deployed about halfway. Once you start your flare, you should take extreme caution in making further adjustments to the airbrakes. If you open the airbrakes when you are too low, you can cause the glider to drop hard onto the ground.

If your glider has the wheel brake connected to the airbrakes, be careful not to have the airbrakes fully deployed when the glider touches down. Otherwise, you will be landing with the wheel brake on, which could easily blow the tire.

As you gain experience, you will be able to make small adjustments to the airbrake setting to precisely control your touchdown point.

Wind Gradient

Any time there is wind, there will be a wind gradient near the ground. The wind speed well above the ground will be higher than the wind speed near the ground. The severity and depth of the gradient depend on the local conditions, terrain, obstructions, trees, and other factors.

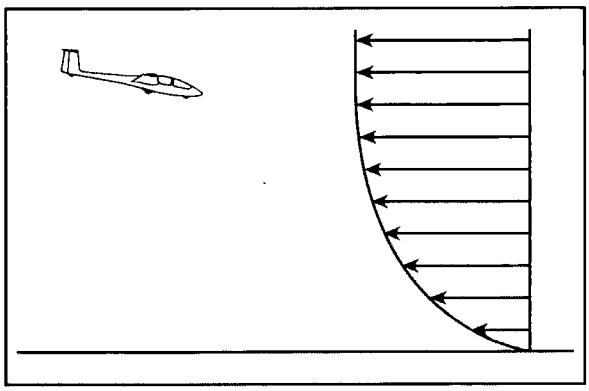


Figure 5.10 – The wind gradient causes the glider's airspeed to decrease as it descends.

As you descend through the wind gradient, you will have to lower the nose of the glider to keep the airspeed from decreasing. This will result in a steeper glide slope. If there is a strong wind gradient, you will need to adjust the airbrakes to keep from undershooting your aim point.

Common Errors

- Failure to maintain a constant airspeed while adjusting the airbrakes
- Failure to achieve the half-airbrake glide slope early on final
- Making abrupt airbrake adjustments close to the ground

Completion Standard

This lesson is complete when you can use the airbrakes to arrive at the aim point with the airbrakes halfway deployed, while maintaining the specified airspeed within +10/–5 knots.

5.4 Radio Use

Purpose

Communicating with other aircraft using the radio helps to minimize the possibility of mid-air collisions, and expedites the smooth flow of traffic around the airport. In this lesson, you will practice and master proper use of the radio.

Procedure

Learning to use the radio is somewhat like learning a new language. Words and phrases can mean different things when used on the radio, and the format is somewhat confusing at first. Radio technique, procedures, and phraseology, are covered in Chapter 13: Radio Communications, of the *Glider Pilot's Handbook of Aeronautical Knowledge*. You should read and become familiar with the information in that chapter before undertaking this lesson.

As with any new "language", the only way to become proficient is to practice. It is often useful to listen to local radio communications on a handheld radio while at the gliderport before or after your lesson.

While on the ground, your instructor will cover typical situations in which you need to use the radio, and teach you specific radio calls. Practice saying these calls on the ground until you can repeat them without hesitation or too much thought.

Once you have mastered saying these radio calls on the ground, your instructor will have you start making actual radio calls while flying. When in the air, think through your transmission before starting it. Make sure you depress the push-to-talk button on the radio a moment before you start speaking, and release it a moment after you are finished so that you do not cut off part of your transmission. Strive for a moderate speaking volume—not too loud or too soft. Speak clearly and not too quickly.

As you start making radio calls, you should start paying closer attention to the calls of other aircraft. You should be able to tell your instructor the general location of other aircraft from the radio calls that they make.

Common Errors

- Interrupting other communications
- Failure to say the direction of the pattern you are flying
- Failure to say the runway you are planning to land on
- Failure to say the airport name at the beginning and end of each position report
- Being to wordy

- Failure to pronounce letters and numbers correctly (for instance, saying "twenty-four" instead of "two four," or using the letter "K" instead of "kilo")

- Failure to acknowledge radio calls made to your glider

- Failure to be aware of the position of other traffic based on their radio calls

Completion Standard

This lesson is complete when you can monitor and use the radio, and are aware of the position of other aircraft based on their radio calls.

5.5 Crosswind Patterns

Purpose

It is easiest to land directly into the wind. Unfortunately, the wind does not always blow straight down the runway. In this lesson, you will learn to fly the pattern to compensate for a crosswind.

Procedure

The wind is rarely blowing straight down the runway or straight across it. Figure 5.11 illustrates the various types of crosswind.

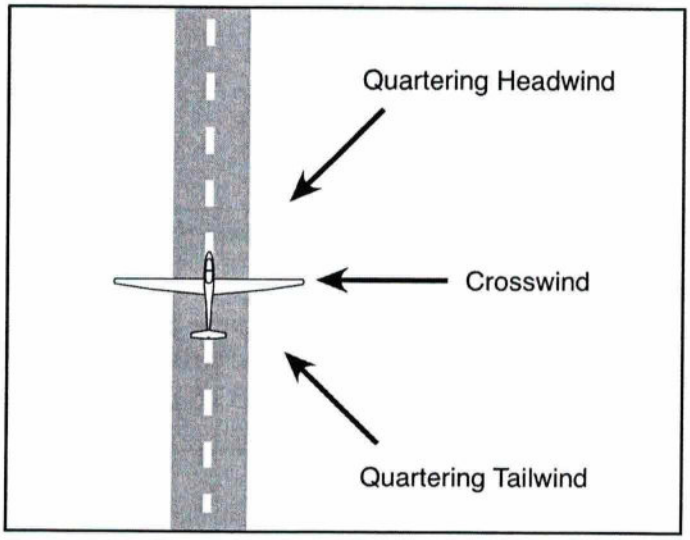


Figure 5.11 – Types of crosswind

In any type of crosswind, you will have to use a crab during the downwind leg and on final. In a quartering wind, you will also have to use a crab during the crosswind and base legs.

If there is a tailwind component on any leg of the pattern, you will perceive that you are going faster than you are. If you try to fly so that the perceived ground speed seems right, your airspeed will be too low. It is therefore that much more important to fly the correct airspeed and pitch angle when the wind is behind you.

Notice in Figure 5.12 that the base leg is flown into the wind. This is the preferred method, especially if the crosswind is strong. If the base leg is flown into the wind, the turn from downwind to base, and from base to final, will require a heading change of less than 90°. In addition, the glider will be crabbed towards the runway on the downwind leg, allowing you a better view and making it easier to determine when to turn base.

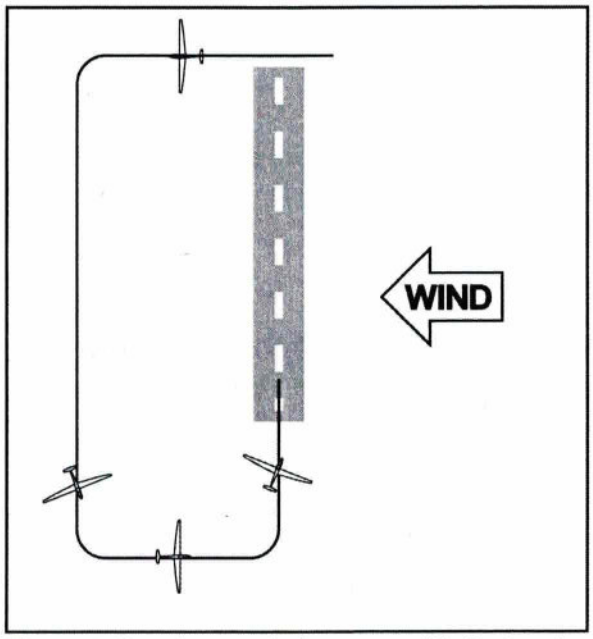


Figure 5.12 – A crosswind pattern with the base leg flown into the wind

Compare that with the situation shown in Figure 5.13, where the base leg is flown with the wind. In this case, the glider must turn through a heading change of greater than 90° when turning from downwind to base, and base to final.

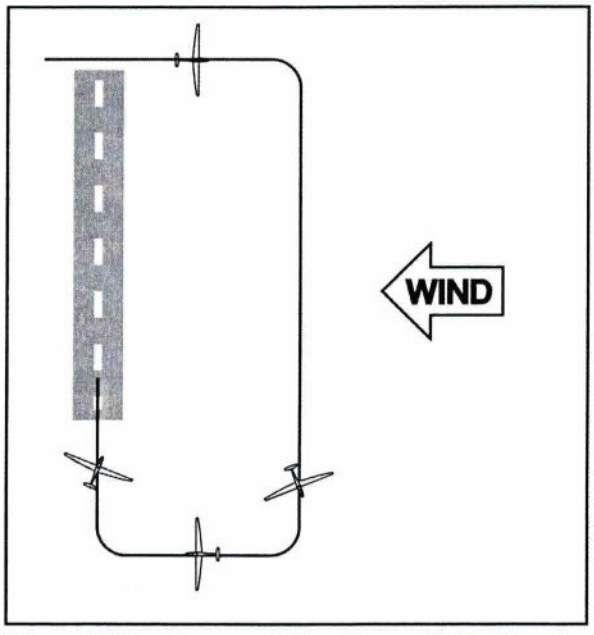


Figure 5.13 – A crosswind pattern with the base leg flown with the wind

Also, notice that the glider is angled away from the runway when on downwind. You will have almost no view of the runway when it is time to turn base if you fly the base leg with the wind.

Another factor to consider is that your ground speed will be higher on base if you fly the base leg with the wind. This leads some pilots to fly too slowly, increasing the likelihood of a stall or spin.

At many airports with multiple runways, the runways are oriented at about 90° to one other. If the winds are strong and blowing between the two runway directions, as shown in Figure 5.14, it is best to land on the runway that allows you to fly the base leg into the wind.

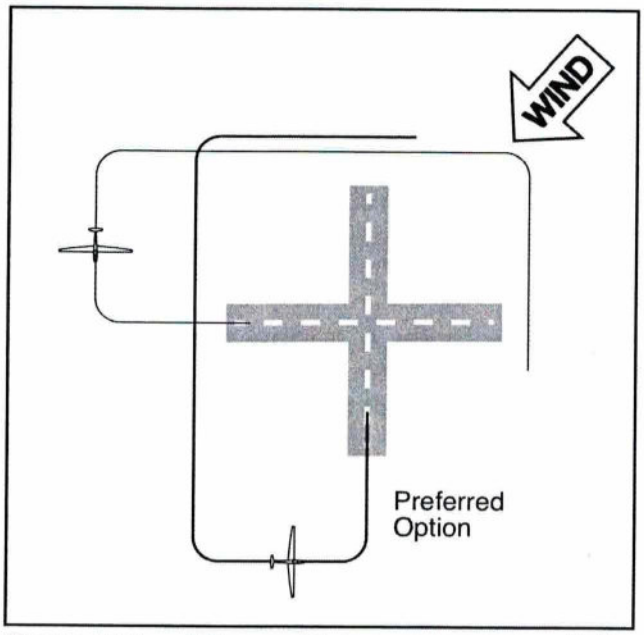


Figure 5.14 – When multiple runways are available, choose the runway that allows you to fly the base leg into the wind while flying the proper pattern direction.

If there is a strong crosswind and only one runway, and you find yourself in a situation where the preferred pattern is opposite the standard pattern, you should probably fly the preferred pattern (the pattern with the base leg into the wind). You have the authority, as pilot in command, to deviate from standard procedures and rules as necessary to ensure your safety.

Common Errors

- Failure to notice a crosswind
- Failure to establish the required crab angle for each leg of the pattern

Completion Standard

This lesson is complete when you can recognize and compensate for a crosswind in the pattern, maintaining the desired airspeed within +10/–5 knots.

5.6 Unusual Patterns

Purpose

For the purpose of this lesson, an "unusual" pattern is one that differs from the one normally flown at your airport. This could be a pattern flown in the opposite direction, with a downwind or base entry, or with a straight-in approach. In this lesson, you will learn to perform unusual patterns, and learn when it is appropriate to execute one.

Procedure

One of the most important guidelines to remember is to fly the situation you *are* in, not the one you *want* to be in. If you have made a mistake and are too low to fly a normal pattern, acknowledge the situation as early as possible while you still have options to deal with it safely. The hardest part of this lesson is not flying the unusual patterns, but making the decision that an unusual pattern is necessary.

If you find yourself too low to fly a normal pattern, your goal should be to intercept the pattern at the point that would be appropriate for your present altitude. For example, if you are at 200 feet AGL and are off the end of a runway, you should simply begin your final approach. If you are at 800 feet AGL, you could be on downwind, or base. If you are at the normal altitude for downwind but on the wrong side of the runway to fly the normal pattern direction, don't switch sides; just fly the opposite direction of pattern.

In this lesson, your instructor will put you in situations in which the safest option is to fly an unusual pattern. It is important to stay calm, fly the glider, maintain your airspeed, and still perform your pre-landing checklist and radio calls.

If you are flying a pattern with a downwind leg, you should still maintain a 25-30° slope to the runway. If you feel you would be too close to the runway if you were to maintain this slope, you should have already turned base! Don't fixate on your "normal" aim point when flying an unusual pattern.

If you find yourself having to fly unusual patterns on a regular basis, you probably are not being careful enough about your glide slope management. In that case, give yourself more altitude to make it back to the airport with a safe margin. "Unusual" patterns should be just that: an unusual occurrence.

Common Errors

- Failure to recognize that an unusual pattern is the best option in a situation
- Flying too tight of a pattern

Completion Standard

This lesson is complete when you can select and fly the pattern appropriate to the situation, maintaining the desired airspeed within +10/–5 knots.

5.7 Forward Slip with Airbrakes

Purpose

There may be situations in which you need to descend faster than is possible with airbrakes alone. This could happen because you hit lift in the pattern, had less headwind than expected, or simply misjudged your pattern. In such cases, you will need to use a slip to increase your descent rate. In this lesson, you will learn how to use a forward slip in addition to airbrakes to increase your descent rate in the pattern.

Procedure

This maneuver is similar to the one you learned in Chapter 4: In-Flight Maneuvers. However, this time you will use airbrakes in addition to the slip, and will be performing the maneuver in the pattern.

Your instructor will set up a situation in which you are much higher than normal on base. When you turn final, open the airbrakes fully, and enter a forward slip to lose altitude as quickly as possible. If you manage to get back onto the half-airbrake glide slope, close the airbrakes halfway and remove the slip.

While in the slip, make sure you keep the pitch angle constant so you don't gain or lose airspeed. Use as much bank angle as possible, but do not use more bank angle than you can balance with rudder. The glider should not change its track while slipping.

Remove the slip and close the airbrakes halfway when you intercept the half-airbrake glide slope. It is important that you remove the slip before touching down; otherwise, you will expose the landing gear to severe side loads.

Common Errors

- Failure to establish sufficient slip to increase the descent rate
- Failure to keep the glider tracking straight down the runway
- Failure to maintain a constant pitch attitude in the slip
- Failure to remove the slip before landing

Completion Standard

This lesson is complete when you can recover from being too high on final by using a slip with the airbrakes, while maintaining the desired airspeed within +10/–5 knots.

5.8 Turning Slips

Purpose

Like the forward slip, which you learned about in the previous lesson, the turning slip helps you to lose extra altitude in the pattern. If you find that when you turn base you are clearly too high, you can enter a slip on base, and keep it in as you turn from base to final. Typically, you will use the turning slip in conjunction with the airbrakes. In this lesson, you will learn to perform a turning slip during the turn from base to final.

Procedure

Your instructor will have you fly the pattern tighter than normal, so that when you turn from downwind to base, you will be very high. You should immediately open the airbrakes and enter a forward slip. The nose of the glider should be to the outside of the turn that you will make from base to final (i.e., if you will be turning left to final, the nose should be to the right during the forward slip on base).

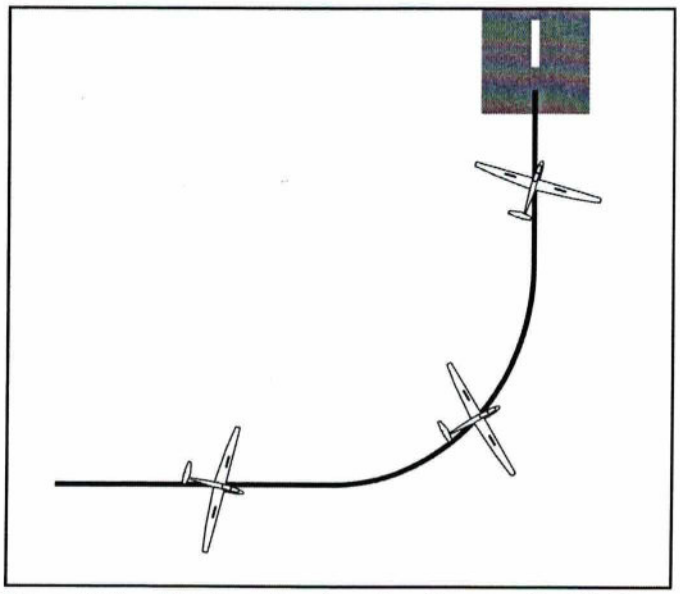


Figure 5.15 – During a turning slip, the nose should always be to the outside of the turn.

When it is time to turn final, simply stay in the slip by holding outside rudder while performing the turn. It is important that you have the nose pointed to the outside of the turn, or else you will skid the turn, possibly setting yourself up for a spin. You will recover from the turn before the nose points down the runway, since it will not point in the direction you are tracking.

If you intercept the half-airbrake glide slope, remove the slip and close the airbrakes halfway; otherwise, stay in the slip until you flare for landing.

Common Errors

- Skidding instead of slipping the glider through the turn
- Failure to keep the pitch attitude constant during the slip
- Failure to remove the slip and adjust the airbrakes once the half-airbrake glide slope is attained

Completion Standard

This lesson is complete when you can slip the glider in the turn from base to final while maintaining the desired airspeed within +10/–5 knots.

5.9 Side Slip in the Pattern

Purpose

A side slip can be used to correct for small alignment errors when on final. It is often safer and easier to perform a side slip to correct for a misalignment than to perform the two coordinated turns that would otherwise be necessary. Previously, you practiced the side slip at altitude. In this lesson, you will use a side slip to correct for an alignment error that your instructor will intentionally create on final.

Procedure

You will perform the side slip just as you learned in Lesson 4.15 while at altitude. The only difference is that you will need to time your recovery from the slip so that you are lined up with the centerline of the runway when you level your wings.

Your instructor will have you fly your final off to one side of the runway. You will then use a side slip to correct the alignment error.

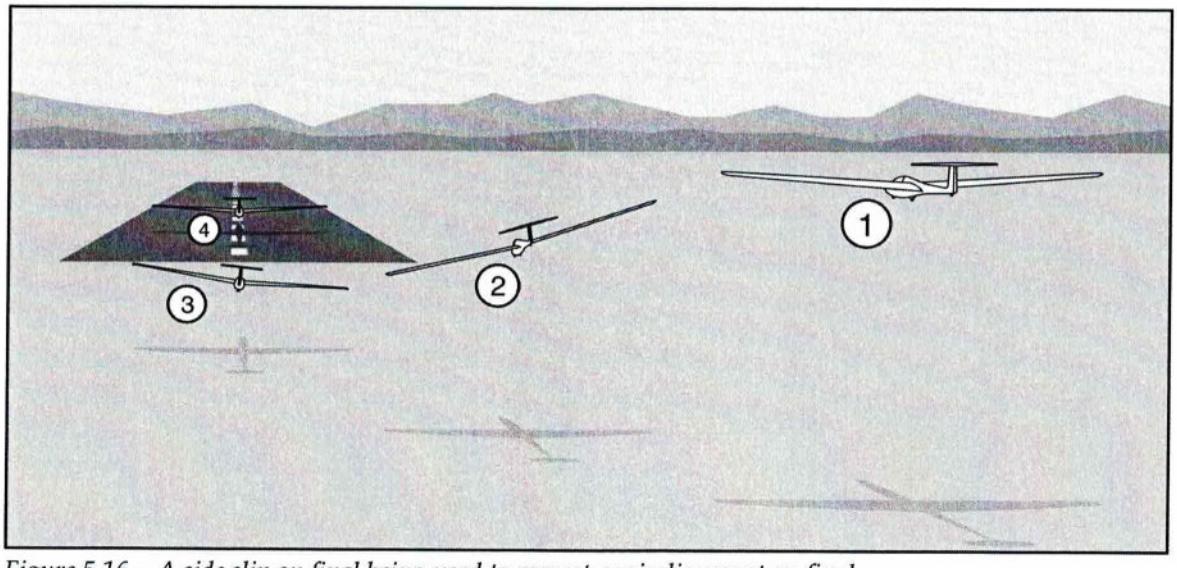


Figure 5.16 – A side slip on final being used to correct a misalignment on final

A side slip is illustrated in Figure 5.16. As you enter the side slip, use coordinated controls to bank the wings ①, then use opposite rudder to keep the nose pointing parallel to the runway. Use the ailerons with opposite rudder to maintain the slip ②.

When you are lined up with the runway, hold the rudder while leveling the wings. Because you have sideways momentum, you will have to bank the wings briefly in the direction opposite of the slip ③, then use coordinated controls to bring the wings back to level ④.

Common Errors

- Failure to keep the fuselage parallel with the runway during the slip
- Using too much bank angle, causing the glider to turn
- Not using enough bank angle to maintain a sufficient slip
- Failure to keep the pitch attitude constant during the slip

Completion Standard

This lesson is complete when you can use a side slip to align the glider with the runway while maintaining the desired airspeed within +10/–5 knots.

5.10 No Altimeter Pattern

Purpose

Quite often you will not be able to rely on the altimeter to give you accurate information when landing. This may happen if the altimeter should fail, or if you must land at an airport or field where the elevation is unknown. Even if you are landing at your home field, the atmospheric pressure may have changed since you took off, causing an error in your indicated altitude. In this lesson, you will learn to fly a normal pattern without reference to the altimeter.

Procedure

If there is ever a discrepancy between your indicated altitude and your perception of the altitude, it is safer to trust the lower of the two. It is better to enter the pattern too high than it is to enter it too low. Since you should be flying the pattern with respect to angles as you learned in Lesson 5.2: Introduction to the Landing Pattern, if you are high, you will simply fly a bigger pattern.

Your instructor will either cover the altimeter before your flight or have you reset it during flight so that it is not correct. Your instructor will also designate a landing area. You must touchdown in this area, and must get the glider stopped within 200 feet but short of the end of the area. You will then have to select your stop, touchdown, and aim points, estimate when you should enter the pattern, and fly the pattern.

When unknowns are involved, most pilots fly too tight and high of a pattern, and end up with too much energy as they approach their aim point. Don't fly closer than normal to the runway on downwind. Don't turn base earlier than normal. Just fly the angles, and any error in your estimate of your pattern entry height will be taken care of automatically.

Common Errors

- Entering the pattern too low
- Failure to fly the proper pattern angles
- Overshooting the aim point

Completion Standard

This lesson is complete when you can accurately fly a pattern without reference to the altimeter while maintaining the desired airspeed within +10/–5 knots, and can land the glider within a designated area, and get the glider stopped within 200 feet but short of a designated point.

5.11 No Altimeter/Airspeed Pattern

Purpose

If your static pressure source were to fail, both your altimeter and airspeed indicator could become inoperative. In this lesson, you will practice flying a pattern without reference to either the airspeed indicator or the altimeter.

Procedure

Your instructor will cover both the airspeed indicator and the altimeter either before or during the flight. Your instructor will also designate a landing area. You must touchdown in this area, and must get the glider stopped within 200 feet but short of the end of the area. You will fly the proper airspeed by reference to the pitch angle, and fly the pattern by reference to the proper angles on downwind and base.

Remember the warning signs of a stall: stick back, nose high, decreasing airspeed, decreasing wind noise, mushy controls, and buffeting. If you sense that you are flying close to stall, lower the pitch attitude.

Select your stop, touchdown, and aim points, and enter the pattern at what you estimate to be a reasonable altitude. Once you establish what you believe to be an appropriate pattern speed, carefully monitor the pitch attitude to keep the airspeed constant. Avoid adding too much extra speed "just to be safe". By this point in your training, you should be quite familiar with the normal pitch attitude of the glider and with its stall warning signs, so that there should be little risk of stalling the glider. Your instructor will let you know if you are flying too slowly. Extra airspeed can cause trouble during the flare and landing.

During the flare, realize that you may be either slower or faster than normal. Do not be overly aggressive on the flare in case you are slow. On the other hand, do not force the glider to land in case you are going too fast. Instead, hold the glider a foot or two off the ground and let the airspeed bleed off until the glider settles onto the runway at the normal landing attitude.

Common Errors

- Entering the pattern too low
- Failure to fly the proper pattern angles
- Flying significantly too slow or too fast in the pattern
- Forcing the glider to touch down at too high of an airspeed

Completion Standard

This lesson is complete when you can perform a pattern and landing without reference to the airspeed indicator or altimeter and can land the glider within a designated area, stopped within 200 feet but short of a designated point.

5.12 No Airbrake Pattern

Purpose

In the event that the airbrakes are inoperative, you can use a forward slip to control your glide slope on base and final. In this lesson, you will learn how to use a forward slip instead of airbrakes to regulate your descent rate in the pattern.

Procedure

The most likely reason why the airbrakes would fail would be if they froze shut. Water, from dew or rain, can get in the airbrakes and freeze at the lower temperatures at high altitudes. If this happens, when you try to open the airbrakes during your pre-landing checklist, you will find that the airbrake handle will not move. Do not force the handle or you could damage the linkage. Instead, you might try flexing the wings a bit by oscillating the stick back and forth, creating alternating positive and negative loads on the wings. This can help to crack the ice, freeing the airbrakes. In this lesson, it will be your instructor, not ice, holding the airbrakes closed!

You should alter your pattern since you will not be able to lose altitude as quickly as you are used to. If the winds are relatively calm and you have a choice of runways, consider the lengths of the runways, obstacles in the approach path, and obstacles that could be a factor should you under- or overshoot the landing. If there is any significant wind, it is best to land into the wind.

Before you attempt a no-airbrake pattern and landing, your instructor will demonstrate one. You will notice that you are much lower, perhaps uncomfortably low, on base and final. Your instructor will start the slip on base and hold the glider in the slip during the flare, then gradually remove it as the glider slows down. By the time the glider touches down, all of the slip should have been removed.

On your turn, make sure that you do not set up your pattern so low that you do not make it to the runway. When you are learning this maneuver it is better to be too high and have to resort to using the airbrakes than to be too low and not make it to the runway. Gradually, you will get a feel for how low the pattern needs to be.

The limit to how pronounced of a slip the glider can do depends on the effectiveness of the rudder. Gliders with large, powerful rudders can slip much more steeply than those with less effective rudders.

While in the slip, you adjust your track using the ailerons, and your glide slope using rudder. Your goal on final should be to use about one-half rudder deflection in the slip. This way, if you find you are getting too high, you have room to increase the slip, and if you are getting too low, you can decrease the slip.

As you start your flare, start removing the slip. Make sure that the lowered wing does not hit the ground. If you remove the slip too abruptly, the glider can climb because of the sudden increase in efficiency. Try to be smooth and graceful on the controls.

Common Errors

- Failure to establish sufficient slip to increase the descent rate
- Failure to keep the glider tracking straight down the runway
- Failure to maintain a constant pitch attitude in the slip
- Failure to remove the slip before landing
- Removing the slip too abruptly
- Forcing the glider to land at too high of an airspeed

Completion Standard

This lesson is complete when you can land the glider using only a slip to control your descent rate while maintaining the desired airspeed within +10/–5 knots.

5.13 Full Airbrake Pattern

Purpose

If the airbrake linkage was to become disconnected or broken, the airbrakes could open, but once open, could not be closed. In this lesson, you will learn to fly a modified pattern to compensate for the extra sink rate caused by fully open airbrakes. This skill could come in handy even if the airbrakes are not stuck open, but the sink rate is high for some other reason, such as rain, a broken canopy, or an encounter with heavy sink.

Procedure

During your pre-landing checklist, as you test the airbrakes, your instructor will hold them open. You must then adjust your pattern to get the glider safely on the runway.

Once you realize that the airbrakes are stuck open, you should tighten your pattern. Instead of using a 30-degree angle to the runway on downwind, use a 45-degree angle. You should also turn base much earlier, and earlier still if there is a headwind. It is important to note how quickly you are losing altitude, and to adjust your pattern appropriately.

Remember that with the airbrakes open, speeding up will cause you to lose altitude much more rapidly because of the increased drag. Keep your speed at your normal pattern airspeed.

If you find that you will not be able to make the runway, choose a clear field in which to land, and inform your instructor of your decision.

Make sure you keep your airspeed up on final, since the glider won't be able to flare if the airspeed gets too low too early.

Common Errors

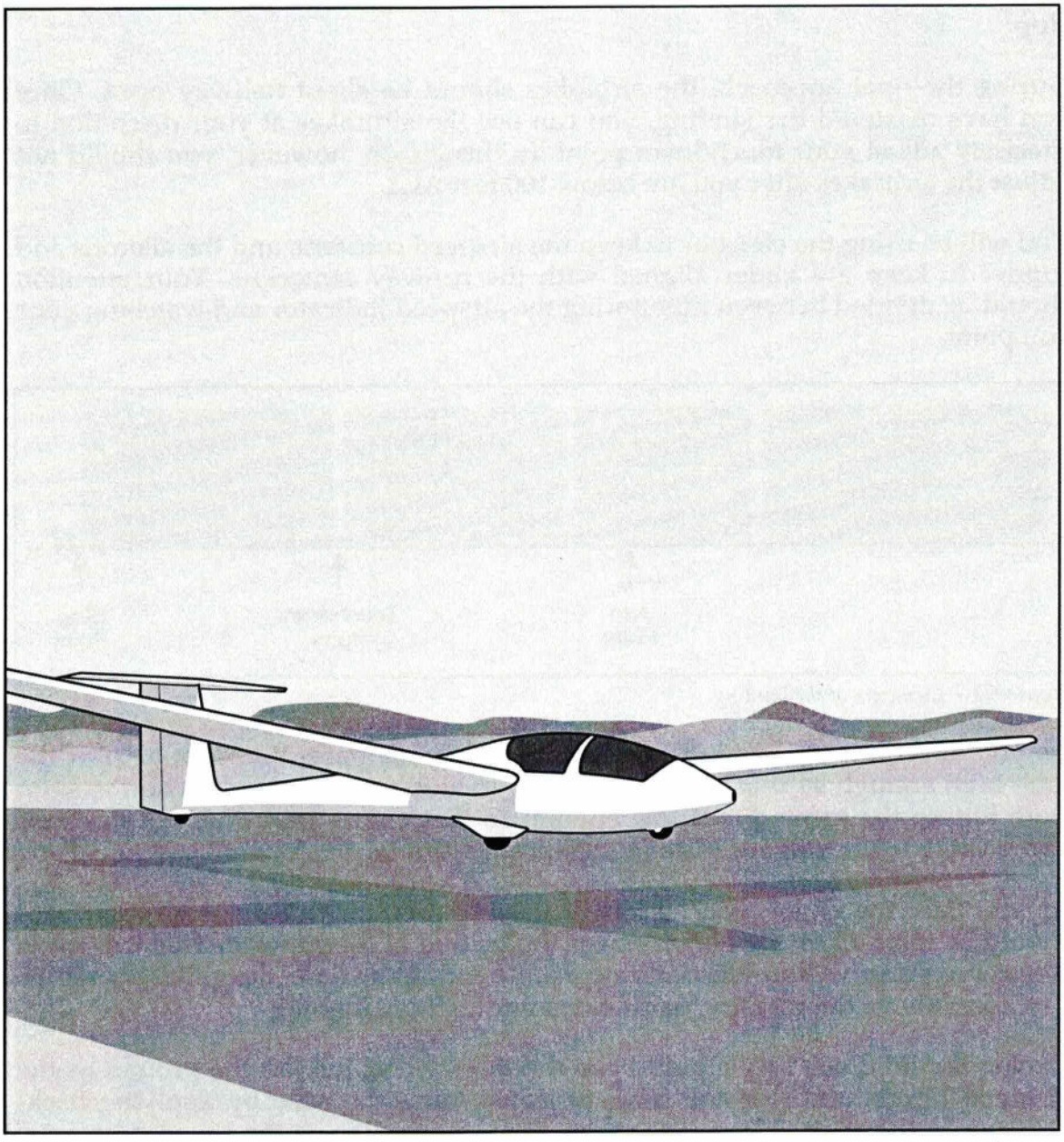
- Failure to respond in a timely manner to the airbrakes' being stuck open
- Failure to hold a constant airspeed
- Failure to identify and designate a suitable landing field if unable to make the runway

Completion Standard

This lesson is complete when you can fly a pattern and land on the runway with the airbrakes fully open while maintaining the desired airspeed within +10/–5 knots.

CHAPTER 6: LANDINGS

The landing is one of the two most critical phases of flight, the other being the takeoff. However, unlike the takeoff, the landing is not optional. Once the glider descends below a certain altitude, a landing is inevitable. You must be prepared to accomplish a successful landing in whatever circumstances you find yourself. In this chapter, you will learn how to perform landings in various conditions.



6.1 Introduction to the Landing

Purpose

In this lesson, you will learn how to land the glider.

Procedure

Elements of the Landing

The landing can be divided into four elements: the approach, the flare, the hold off, and the rollout. During the approach, you are descending towards your aim point. The flare is used to transition between the descent of the approach to the level flight of the hold off. During the rollout the glider is gently brought to a stop.

During the final approach, the airbrakes should be about halfway open. Once you have mastered the landing, you can use the airbrakes at your discretion to precisely adjust your touchdown point. In this lesson, however, you should not adjust the airbrakes after you are below 100 feet AGL.

You will be using the elevator to keep the airspeed constant, and the ailerons and rudder to keep the glider aligned with the runway centerline. Your attention should be divided between monitoring the airspeed indicator and watching your aim point.

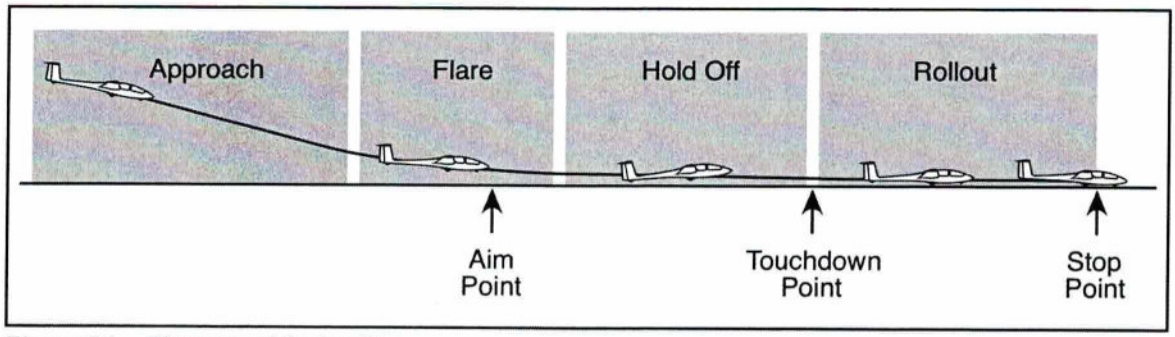


Figure 6.1 – Elements of the landing

As you approach the ground you should start your flare. You should start the flare high enough so that you do not need to abruptly change direction to keep from hitting the ground, but low enough so that your speed does not decrease appreciably while you are still at a significant altitude.

As you flare the glider, you no longer need to monitor the airspeed. Your eyes should be focused on the horizon over the far end of the runway. This will make it easier to perceive your descent rate. At the end of the flare, the glider should be 1 to 2 feet above the runway, neither descending nor climbing.

During the hold off, you should keep the main wheel just off the ground as the airspeed bleeds off. You will have to slowly raise the nose by applying back-pressure to the stick to keep the glider from descending as the speed decreases. You should keep raising the nose until the glider is at an attitude where the tail

wheel is level with, or slightly lower than the main wheel. (To see what this attitude looks like, before the flight, sit in the glider and have your instructor hold the tail wheel to the ground.)

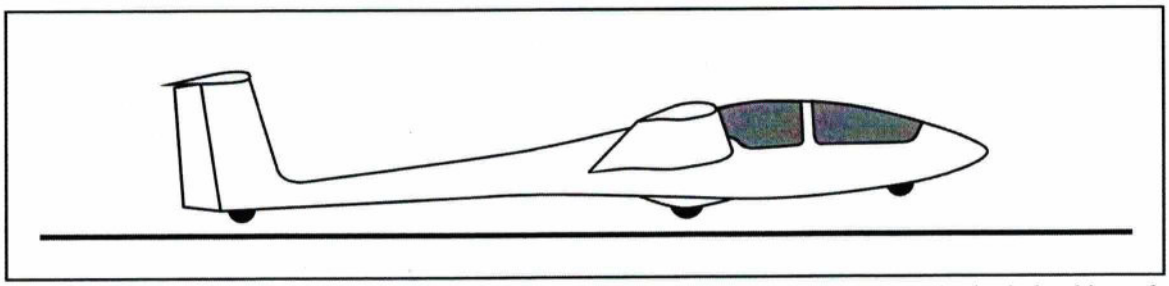


Figure 6.2 – Landing attitude, with the tail wheel level with the main wheel. The tail wheel should touch down at the same time, or slightly before the main wheel.

If you hold this attitude, the glider will gently settle onto the ground as the airspeed decays. Ideally, you will perform a "two-point" landing, with the main wheel and the tail wheel touching down simultaneously, or a tail wheel-first landing, with the tail wheel touching down slightly before the main wheel.

Once the glider touches down, keep flying it! Keep your wings level using the ailerons, keep the glider on the runway centerline using the rudder, and keep the glider balanced on the main wheel as long as possible using the elevator. Gently use the wheel brake to bring the glider to a stop.

Ground Effect

As you get within about one wingspan of the ground, you will notice that the glider seems to "float" along, as if the drag had decreased. In fact, that is exactly what happens. The closer the wings are to the ground, the more the ground interferes with the development of the wing tip vortices. Since these vortices are responsible for the induced drag, the glider actually becomes more efficient the closer it gets to the ground. (See Chapter 3: Aerodynamics, in the *Glider Pilot's Handbook of Aeronautical Knowledge* for a description of induced drag and ground effect.)

Pilot-Induced Oscillations (PIOs)

If you land the glider at the proper attitude, the main wheel and the tail wheel will both touch down at the same time, or the tail wheel will touch down just before the main wheel. This prevents the angle of attack of the wing from increasing and the glider from "bouncing" back into the air. (Most "bounced" landings are really not bounces. They are the result of an increase in the angle of attack of the wing while the glider still has enough speed to fly, which lifts the glider back into the air.)

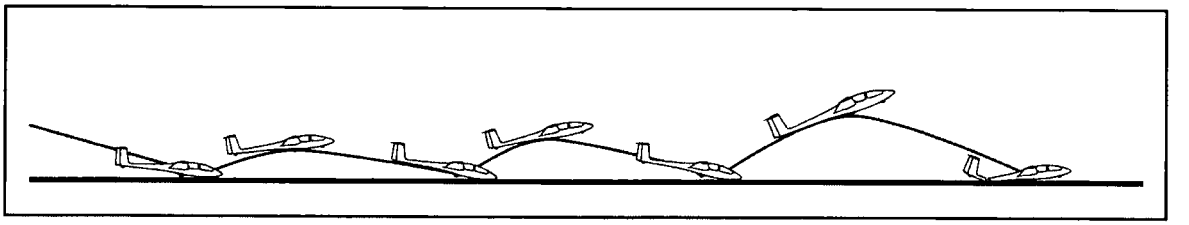


Figure 6.3 – Pilot-induced oscillations (PIOs) result from trying to force the glider back onto the ground after a bounced landing.

When the glider "bounces" after a landing, most pilots have a tendency to try to force the glider back onto the ground as soon as possible by pushing forward on the stick. (Maybe they think if they keep the bounce small enough nobody will notice?) All this does is make the next bounce even worse. After a couple of PIOs, the glider may be slamming into the ground with enough force to damage it.

If you bounce a landing, close the airbrakes and bring the nose of the glider to the landing pitch attitude. Hold the pitch attitude constant and allow the glider to touch down as the airspeed decreases. Forcing the glider onto the ground before it is ready is a sure way to start a PIO. The best way to avoid a PIO is to land the glider slightly tail wheel-first.

Common Errors

- Failure to keep the glider aligned with the centerline during the final approach
- Flaring too early
- Flaring too late, or not at all
- Allowing the glider to touch down too early, i.e., at too high of an airspeed
- Failure to keep the glider aligned with the centerline after touchdown
- Failure to keep the glider balanced on the main wheel as long as possible after touching down

Completion Standard

This lesson is complete when you can consistently perform a two-point or tail wheel-first landing and control the glider during the rollout, keeping it within 15 feet of the centerline.

6.2 Precision Landings

Purpose

In the previous lesson, your goal was simply to make a smooth landing on the runway without any constraints on where the glider was to touch down or come to a stop. In this lesson, you will make small adjustments to the airbrakes during the hold off to fine-tune your touchdown and stop points.

Procedure

Before the flight, your instructor will designate a portion of the runway as the landing area and will designate a stop point. Your goal is to touch down within the landing area, and to get the glider stopped before, but within 200 feet of the stop point.

While in the pattern, you should locate the designated stop point and then determine your touchdown and aim points. Your touchdown point must be within the designated landing area.

You should pay particular attention to flying a precise pattern. If you arrive at your aim point at the pattern speed with the airbrakes half-deployed, the rest of the landing should be relatively simple. As you approach the aim point, make small adjustments to the airbrake setting as necessary. (You are no longer constrained to using only the closed, half, or full airbrake setting.)

During the hold off, keep the glider 6 to 12 inches above the ground. If you feel you have extra speed, you can very gently increase the amount of airbrake; just be careful not to drop the glider to the ground. If you feel that you may not make it to the beginning of the designated landing area, you can gently close the airbrakes as necessary. Any time you are close to the ground, you should make changes to the airbrake setting very smoothly and gradually. The goal is to arrive at the edge of the designated landing area with the glider at the proper landing attitude.

Once you are over the designated landing area, smoothly and gently increase the airbrakes. If the glider is not yet at the proper landing attitude, hold it off the ground until it is, then allow the glider to settle gently onto the runway. If you touch down before the glider is at the proper landing attitude, the glider will most likely bounce back into the air, using up more runway and possibly entering a PIO.

After the glider touches down, use the airbrakes and wheel brake as necessary to stop the glider at the designated stop point. Your goal is to get the glider stopped within 200 feet of the point without rolling past it.

Common Errors

- Failure to maintain proper airspeed on final

- Overshooting or undershooting the aim point
- Touching down before the designated landing area
- Failure to achieve proper landing attitude before allowing the glider to touch down
- Failure to remain within 5 feet of the runway centerline during the touchdown and rollout
- Failure to get stopped before the designated stop point
- Stopping more than 200 feet before the designated stop point

Completion Standard

This lesson is complete when you can consistently perform a smooth two-point or tail wheel-first landing, touching down within a designated landing area within 5 feet of the centerline, and stopping within 200 feet but short of a designated point.

6.3 Crosswind Landings

Purpose

While a crab angle can be used to compensate for a crosswind at altitude, during a landing, a different technique must be used to avoid excessive side loads on the main wheel. In this lesson, you will learn to compensate for a crosswind while landing by using a side slip.

Procedure

When the winds are appropriate, your instructor will have you land in a crosswind. On final approach, you will be using a crab angle to keep the glider tracking straight down the runway. Some time before touchdown, you will have to transition to a side slip so that the glider does not touch down while traveling sideways.

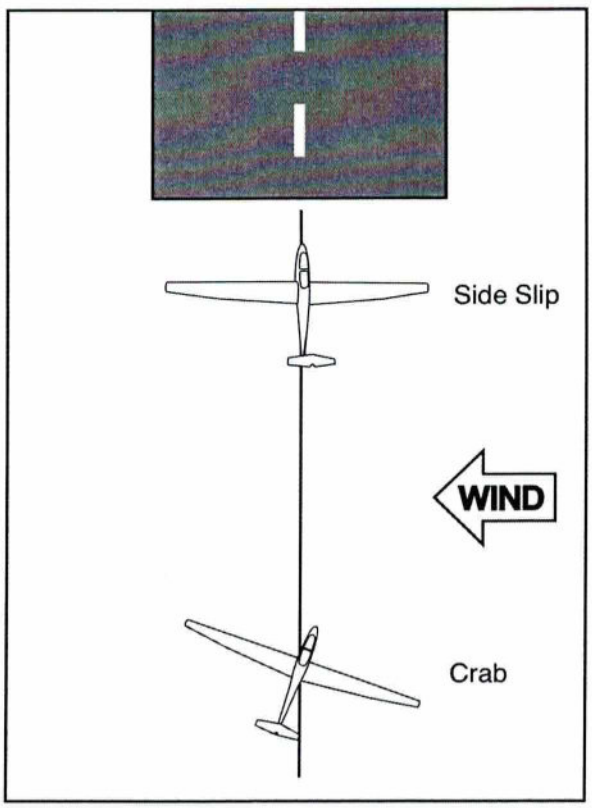


Figure 6.4 – Transitioning from a crab on final to a side slip before touchdown

Some pilots prefer to transition to a slip while still high on final, while others don't transition until after the flare. For most students, it is easier to transition high on final so that the timing is not so critical, and you have more time to stabilize the slip and make adjustments before touching down.

As you descend through the wind gradient, you will probably notice that less slip is required because the wind speed, and therefore the crosswind, decreases.

While in the slip, use bank angle to adjust your track, and rudder to adjust your heading. You will stay in the slip all the way through touchdown and rollout. Keep in mind that the slip creates extra drag, increasing your descent rate. If the glider is coming down too quickly, reduce the amount of airbrake you are using.

As when performing a normal landing, you should let the speed bleed off by maintaining level flight a few inches off the ground, and then let the glider settle onto the ground once it reaches the proper pitch attitude for landing.

Once on the ground, it is important to keep the glider pointing straight down the runway. It will have a tendency to turn into the wind. In strong winds, you may want to veer slightly to the downwind side of the runway early in the rollout, so that you will have more runway on the upwind side when you start to lose directional control as you slow down.

When you get to the point where you can no longer maintain the desired ground track, you should get the glider stopped as soon as possible by applying the wheel brake.

Common Errors

- Failure to maintain the desired airspeed
- Failure to touch down with the fuselage of the glider aligned with the flight path
- Failure to maintain alignment with the runway centerline
- Allowing the glider to touch down too early
- Failure to stop the glider when directional control is lost on the rollout

Completion Standard

This lesson is complete when you can consistently perform a smooth two-point or tail wheel-first landing in a crosswind, touching down within a designated landing area, and stopping within 200 feet but short of a designated point.

6.4 Landing Over an Obstacle

Purpose

Some landing areas are surrounded by trees, power lines, fences, or other obstacles. In this lesson, you will learn how to land the glider and get it stopped using as little runway as possible after clearing an obstacle in your flight path.

Procedure

In this lesson, your instructor will have you land over an imaginary obstacle at the end of the runway.

An obstacle in your flight path on final effectively shortens the usable length of the field by about ten times its height. You must consider this when deciding on the suitability of a field for landing.

The first objective when landing over an obstacle is to clear the obstacle. Instead of aiming at a point on the ground, you will aim just over the top of the obstacle. It is crucial that you maintain your airspeed. Ideally, you will clear the obstacle with the airbrakes half open.

Once you have cleared the obstacle, you will use full airbrakes, and if necessary, a full slip to get the glider on the ground in the available runway. When you add the airbrakes, you will also need to lower the nose to keep from slowing down. However, be careful not to dive the glider into the ground.

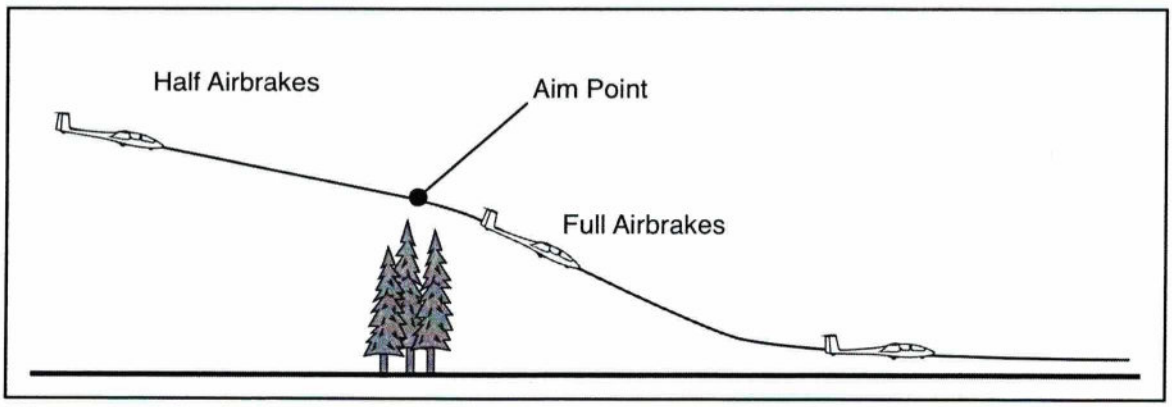


Figure 6.5 – When landing over an obstacle, use a point just above the obstacle as your aim point. Apply full airbrakes as soon as you clear the obstacle.

The use of full airbrakes after clearing the obstacle requires the use of a more aggressive flare than usual. If you have not kept your airspeed constant, you may have to close the airbrakes as you flare to keep the glider from stalling.

As with any landing, hold the glider a few inches off the ground until the airspeed dissipates, and the glider settles onto the ground at the proper attitude. Do not have the wheel brake engaged when touching down or the tire can wear excessively or even fail.

Once you touch down, apply the wheel brake to get the glider stopped as quickly as possible, but without locking up the main wheel.

Common Errors

- Not clearing the simulated obstacle
- Being too high when clearing the simulated obstacle
- Failure to maintain a constant airspeed
- Not flaring soon enough
- Failure to touch down at the proper landing attitude
- Touching down with the wheel brake engaged

Completion Standard

This lesson is complete when you can consistently perform a smooth two-point or tail wheel-first landing and get the glider stopped within a designated distance after clearing a simulated obstacle on final, while maintaining the specified airspeed within +10/–5 knots.

6.5 Simulated Off-Field Landing

Purpose

Any time you land off of an airport, you will not know the condition of the landing surface. It is therefore important that you touch down as slowly as possible and keep the rollout as short as possible to avoid or minimize damage to yourself or the glider. In this lesson, you will practice landing the glider with minimum energy (i.e., speed) and getting it stopped as quickly as possible.

Procedure

You should fly a normal pattern and final approach when landing off-field. During the hold off, keep the glider in the air as long as possible. The stall speed is higher with the airbrakes deployed. By gradually closing the airbrakes as the glider slows down, you can slow the glider down a bit more before it stalls. Ideally, the glider should be almost stalled as the tail wheel touches the ground.

As the glider touches down, open the airbrakes all the way and firmly apply the wheel brake. Keep the stick back to keep the weight on the main wheel, not on the nose wheel. This will improve the braking authority. Try not to lock up the wheel, as this can damage the tire and prevent you from stopping as quickly.

Common Errors

- Allowing the glider to touch down with more speed than necessary
- Not applying the airbrakes and wheel brake as soon as you touch down

Completion Standard

This lesson is complete when you can consistently perform minimum-energy landings.

6.6 Downwind Landings

Purpose

Normally you will land into the wind if possible. However, there may be circumstances that require you to land with the wind. If the tow rope breaks at low altitude, you may have to do a 180° turn and land downwind on the runway from which you just took off. Or you may have to land on a sloping runway, where it is preferable to land uphill rather than into the wind. In this lesson, you will learn how to perform downwind landings.

Procedure

In a light to moderate wind, your instructor will have you land with a tailwind.

Your glide slope will be shallower when you fly with the wind. You may need to set up your approach so that you are lower than normal to keep from overshooting your aim point.

When you land with a tailwind, the wind gradient has the effect of flattening your glide slope. This is the opposite effect that the wind gradient has on your glide slope when you land into the wind.

Your ground speed will be much higher than normal. You should pay special attention to flying the correct pitch attitude and airspeed. Do not let the higher ground speed fool you into flying too slowly.

Also, make sure that the higher ground speed doesn't cause you to flare higher, or keep the glider higher during the hold off. Watch the pitch attitude, and when the glider is at the proper landing attitude, let it settle onto the runway, even though the ground speed may seem higher than you are used to.

After touchdown, you should keep the nose wheel (skid) off the ground for as long as possible by holding full back-stick. If possible, hold the tail wheel on the ground. This makes it easier to keep the glider tracking straight down the runway.

Keep the glider centered on the runway. Do not veer to the side of the runway or the glider may turn back sharply into the wind as it slows to a point where the rudder is no longer effective. If you are no longer able to maintain the desired ground track, you should use the wheel brake aggressively to get the glider stopped.

If your canopy is hinged at the front, after you have stopped, be careful as you open it. You will be used to the wind trying to blow the canopy back closed. Coming from the opposite direction, it may try to open the canopy, possibly yanking it out of your hands.

Common Errors

- Failure to account for the tailwind when setting up the final approach
- Failure to maintain the desired airspeed
- Overshooting the aim point
- Failure to keep the glider on the runway centerline after touchdown
- Failure to get the glider stopped quickly if directional control is lost

Completion Standard

This lesson is complete when you can consistently perform a smooth two-point or tail wheel-first landing with a tailwind while maintaining the specified airspeed within +10/–5 knots up to the flare.

6.7 High Wind Landings

Purpose

High winds pose special challenges to the pilot during a landing. As in a downwind landing, visual cues may be misleading, and you must keep a careful eye on the airspeed and pitch attitude. In this lesson, you will learn how to perform high wind landings.

Procedure

High winds cause three major changes in the way the glider handles in the pattern.

First, on downwind you will notice that your ground speed is very high. Fly the correct pitch attitude and airspeed, not the ground speed. If you slow down until the ground speed seems correct, you could easily stall the glider because the airspeed will be so low.

Second, since on downwind your ground speed is higher, and since your glide slope will be much steeper on final, you will have to turn base earlier. In very high winds, it is prudent to turn base when still abeam the aim point.

Third, on final your ground speed will seem very slow, which may make you want to pitch the nose down and increase the airspeed so that things seem more "normal". You must resist this temptation, and instead concentrate on flying the correct airspeed and pitch attitude.

With strong winds, there is also usually a strong wind gradient. The wind speed can drop significantly in the last 100 to 50 feet. Any obstacles upwind can make the gradient worse. Buildings, trees, etc., can cause a sudden drop-off in wind speed. Be alert, and expect to encounter a wind gradient when the winds are high.

You may have a tendency to touch down with too much airspeed in high winds. Once again, fly the pitch attitude, not the ground speed. Concentrate on touching down at the right pitch attitude. If you touch down with too much airspeed, the glider can bounce back into the air, possibly stalling or setting you up for PIOs. Once you are on the ground, open the airbrakes to keep the glider on the ground.

If the winds are too high, you may not be able to get out of the glider once you get it stopped without assistance. If the glider feels like it will be unstable if you let go of the controls, stay in the cockpit, wait for help, and keep "flying" the glider. Keep it pointed into the wind with the wings level, and keep the airbrakes fully open. If no one is available, stay put until the winds calm down. The strong winds from a gust front rarely last more than 10 to 15 minutes.

Common Errors

- Failure to maintain the correct airspeed
- Not turning base early enough for the wind conditions
- Failure to touch down at the proper landing attitude

Completion Standard

This lesson is complete when you can fly the pattern in a high wind maintaining the specified airspeed within +10/–5 knots, and perform a smooth two-point or tail wheel first landing touching down within a designated landing area and stopping within 200 feet but short of a designated point.

6.8 High Density Altitude Landings

Purpose

If you are learning to fly at an airport near sea level, you will probably be surprised the first time you perform a landing at a runway located in the mountains. This will be especially true if the day is hot. Your ground speed at touchdown can be significantly higher than what you are used to. While you may not have the opportunity to perform a high altitude landing during your training, in this lesson you will learn about the factors involved in a high altitude landing.

Procedure

Density altitude is explained in Chapter 5: Flight Instruments and Systems, of the *Glider Pilot's Handbook of Aeronautical Knowledge.* Low pressure, high temperature, or high altitude will all increase the density altitude.

When the density altitude is high, the air density is low, so the glider will need more airspeed to create the same amount of lift. The indicated airspeed will be the same (the density affects the airspeed indicator the same way it affects the lift produced), but the true airspeed and the ground speed will be higher.

Because of the higher ground speed, the glider will use more runway. You should adjust your aim and touchdown points accordingly.

During a high altitude landing, your ground speed will also be much higher during the hold off. Fly the same pitch attitude you would fly during a normal landing, and let the glider settle onto the ground when it is ready. Do not let the perception of high ground speed mislead you into raising the nose of the glider. This can result in a stall, or a hard, tail-first landing.

Common Errors

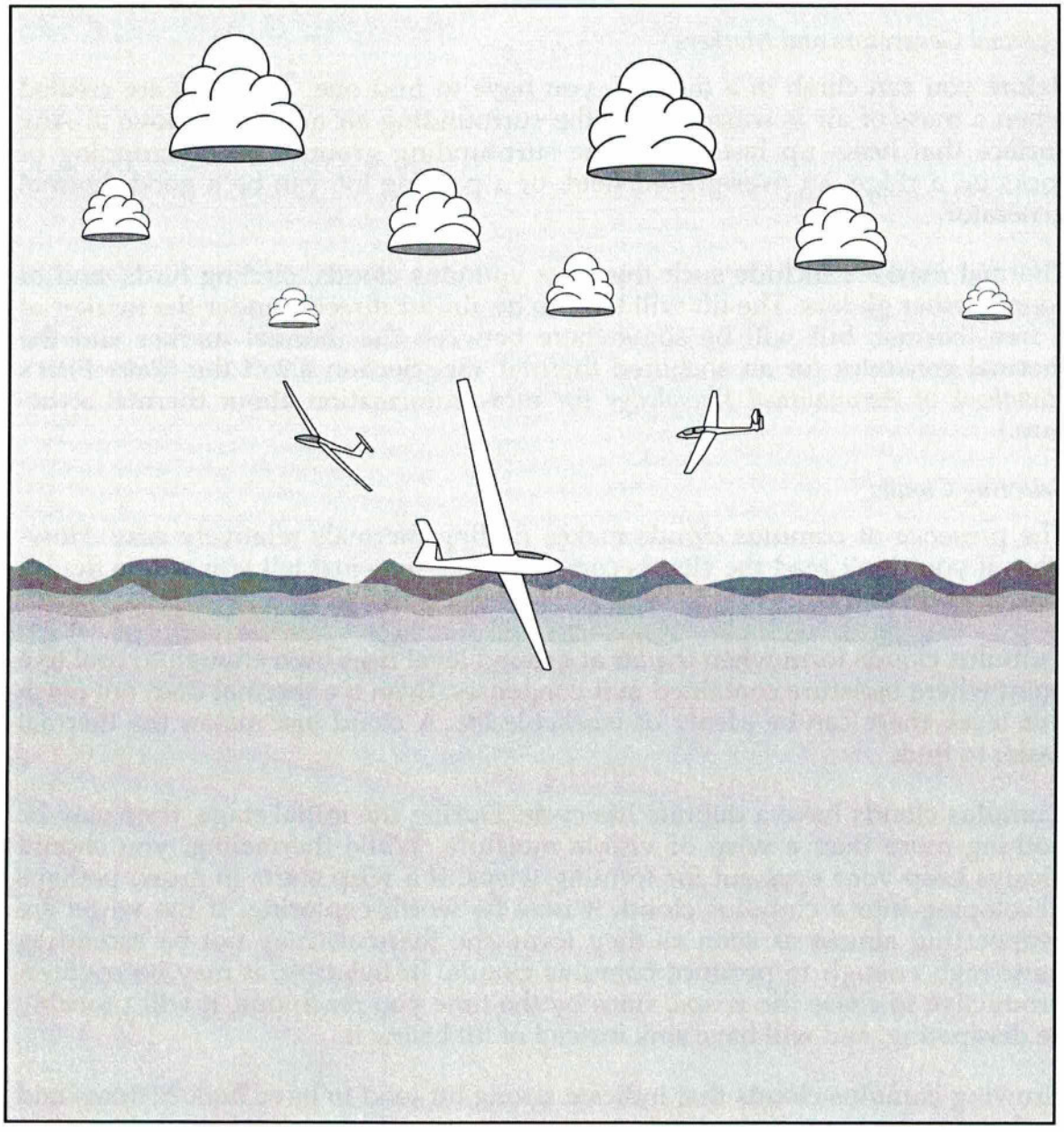
- Not taking into account the extra runway needed for a high altitude landing
- Failure to maintain the desired airspeed

Completion Standard

This lesson is complete when you understand and can explain how high density altitude affects the glider during a landing.

CHAPTER 7: FLYING IN LIFT

Gliding is fun, but soaring is more fun! The ability to climb in rising air—to sustain yourself aloft indefinitely—is what soaring is all about. In this chapter, you will learn how to soar in the four main types of lift used by glider pilots.



7.1 Thermaling

Purpose

Thermal lift is by far the most common type of lift used by soaring pilots. The purpose of this lesson is to teach you how to identify and use thermal markers, how to select the best clouds for lift, how to fly in gaggles, and how to maximize your climb rate while thermaling.

Procedure

Thermal Generators and Markers

Before you can climb in a thermal, you have to find one. Thermals are created when a mass of air is warmer than the surrounding air and rises above it. Any surface that heats up faster than the surrounding ground, an outcropping of rocks on a ridge, an over-grazed field, or a parking lot, can be a good thermal generator.

Thermal markers include such things as cumulus clouds, circling birds, and of course, other gliders. The lift will tend to be almost directly under the marker of a free thermal, but will be somewhere between the thermal marker and the thermal generator for an anchored thermal. (See Section 6.9 of the *Glider Pilot's Handbook of Aeronautical Knowledge* for more information about thermal structure.)

Selecting Clouds

The presence of cumulus clouds makes finding thermals relatively easy. However, if you don't read the clouds correctly, they may just tell you where the lift was, not where it is.

Cumulus clouds form when the air at ground level rises high enough to cool to a point where moisture contained in it condenses. Even if a thermal does not reach this level, there can be plenty of workable lift. A cloud just makes the thermal easier to find.

Cumulus clouds have a definite life cycle. During the initial stage, they may be nothing more than a wisp of visible moisture. While thermaling, you should always keep your eyes out for forming wisps. If a wisp starts to grow, perhaps developing into a cumulus cloud, it may be worth exploring. If the wisps are evaporating almost as soon as they form, the thermals may not be ascending quite high enough to produce cumulus clouds. In this case, it may be counterproductive to chase the wisps, since by the time you reach one, it will probably be dissipating, and will have sink instead of lift below it.

Growing cumulus clouds that indicate strong lift tend to have dark bottoms and well defined edges. If the lift is particularly strong, the cloud may develop a concave bottom, where the lift will be strongest.

As the lift decays and turns to sink, the cloud will start to look ragged, fuzzy, or blurry around the edges. It is best to avoid decaying clouds, as they can indicate strong sink.

Flying in a Gaggle

If you fly in the vicinity of other gliders, you will eventually have to share a thermal with them. There are a few basic rules for flying in a "gaggle".

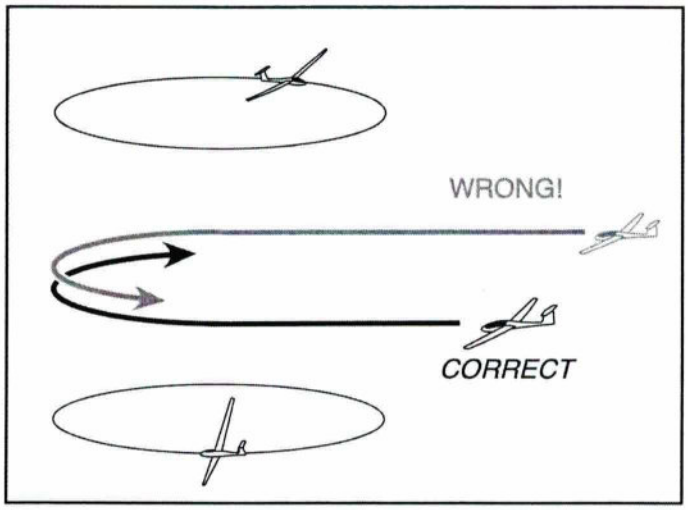


Figure 7.1 – When entering an occupied thermal, always turn in the same direction as the other glider(s).

The first glider to work a thermal establishes the direction to fly in that thermal. Even if you enter the thermal well above or well below the other glider, turn in the same direction so that if more gliders join the thermal, everyone is turning in the same direction.

Gliders already in a thermal should not have to maneuver to avoid you as you enter the thermal. Approach the gaggle carefully, and once in the thermal, match the other glider's bank angle and speed so that you fly the same size circle as they are flying. Slow down to thermaling speed before entering the thermal to avoid climbing though circling gliders as you enter the thermal.

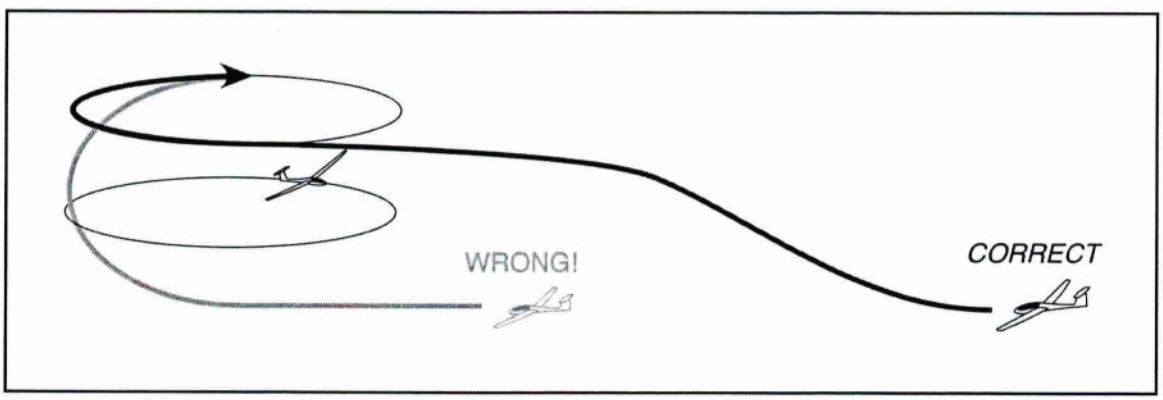


Figure 7.2 – Slow down to thermaling speed before joining another glider in a thermal.

If you are at the same level as another glider, try to maneuver so that you are on opposite sides of the circle. Avoid flying in another glider's blind spot, i.e., directly below or behind it. Many pilots get justifiably nervous when they know that a glider has joined their thermal but can't see it.

A glider climbing faster than others must give way to any slower climbing gliders. This is necessary because a higher glider will not have a good view of any lower gliders.

And finally, look outside. Do not stare at the vario when thermaling, even if you think there are no other gliders around you. A circling glider attracts other gliders like a light attracts moths! You should also look outside to look for power traffic and birds.

Maximizing Climb Rate

There are many variables that affect how fast a glider climbs in a thermal, such as the size of the thermal, the bank angle of the glider (which affects the size of the circle and the sink rate of the glider), the airspeed of the glider, the weight of the glider, and how well the pilot keeps the glider centered in the thermal.

As you can see in Figure 7.3, as the bank angle increases, the turning radius decreases. (The chart was developed for a Grob 103, but the curves are similar for any glider.) There is not much decrease in the turning radius for bank angles greater than 50°. The sink rate is not much greater than in level flight for bank angles up to about 30°. However, past 50°, the sink rate increases dramatically.

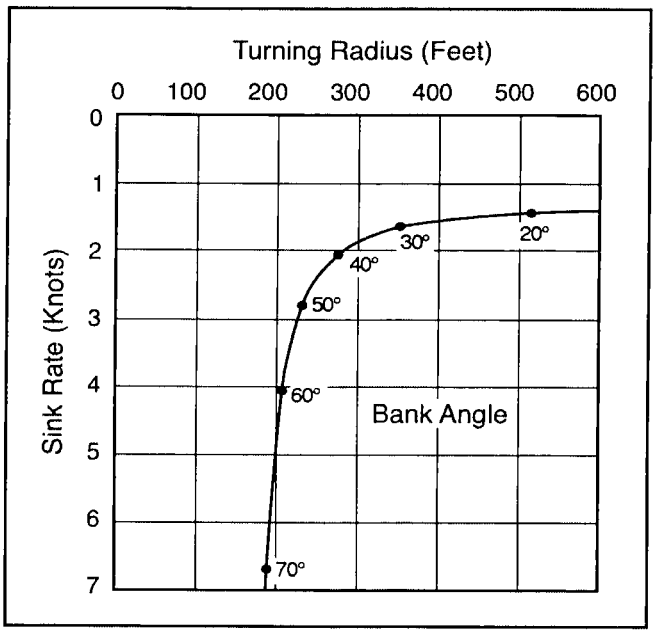


Figure 7.3 – Increasing the bank angle decreases the turn radius but increases the sink rate.

All this information is presented to convince you to use a 45° bank angle when entering a thermal. (You learned in Lesson 4.6 how to determine a 45° bank angle.) If necessary, you can adjust the bank angle once you are established in the thermal.

One of the hardest things about thermaling is centering the thermal. There are almost as many ways to work a thermal as there are glider pilots, but what follows is a good starting point for developing your own thermaling technique.

As you encounter lift, you should keep flying straight until you reach the point of maximum lift. You will have to identify this point mostly by the "seat of your pants", since the vario will lag behind too much to be very useful.

As you reach the point of maximum lift, you should enter a turn. If after a 90° turn, the lift has stayed constant, stay in the turn. If the lift has increased, level out until it peaks again, then turn again in the same direction. If the lift has decreased after your first 90° turn, stay in the turn for another 180°, then level out and wait for another peak in the lift, then start another turn in the same direction. A flowchart illustrating this strategy is shown in Figure 7.4.

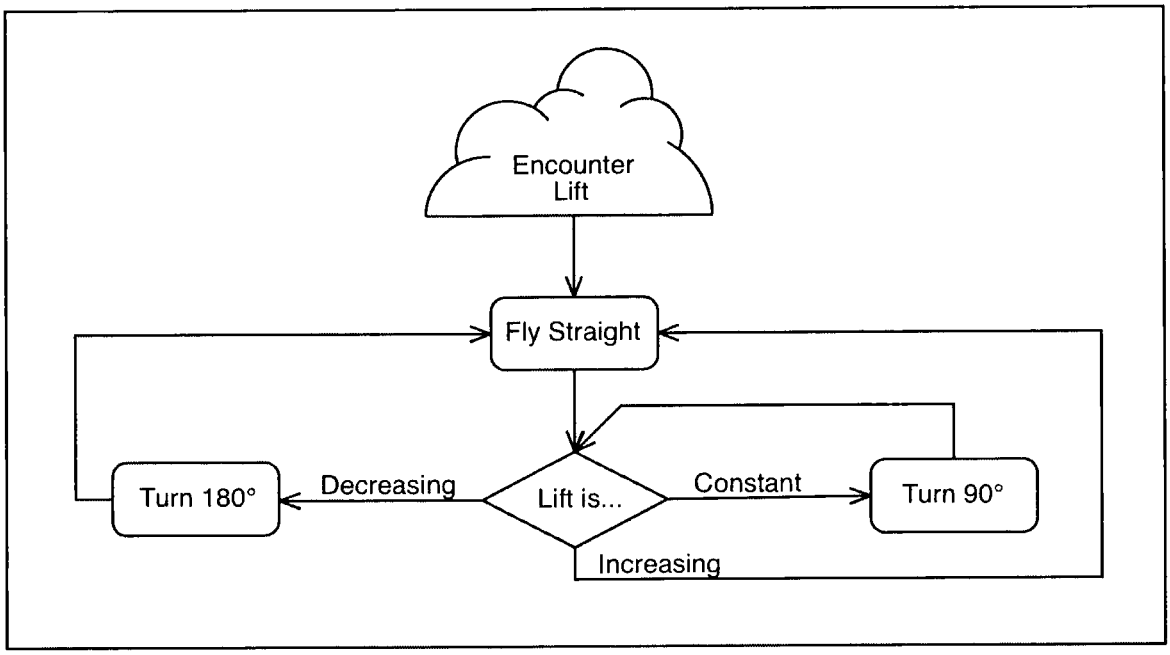


Figure 7.4 – Thermaling algorithm

Let's see how this applies to an "ideal" thermal. In Figure 7.5, the pilot encounters lift at ①, so continues to fly straight. The lift peaks at ②. The pilot senses at this point that the glider is no longer accelerating upward. In other words, the lift is constant.

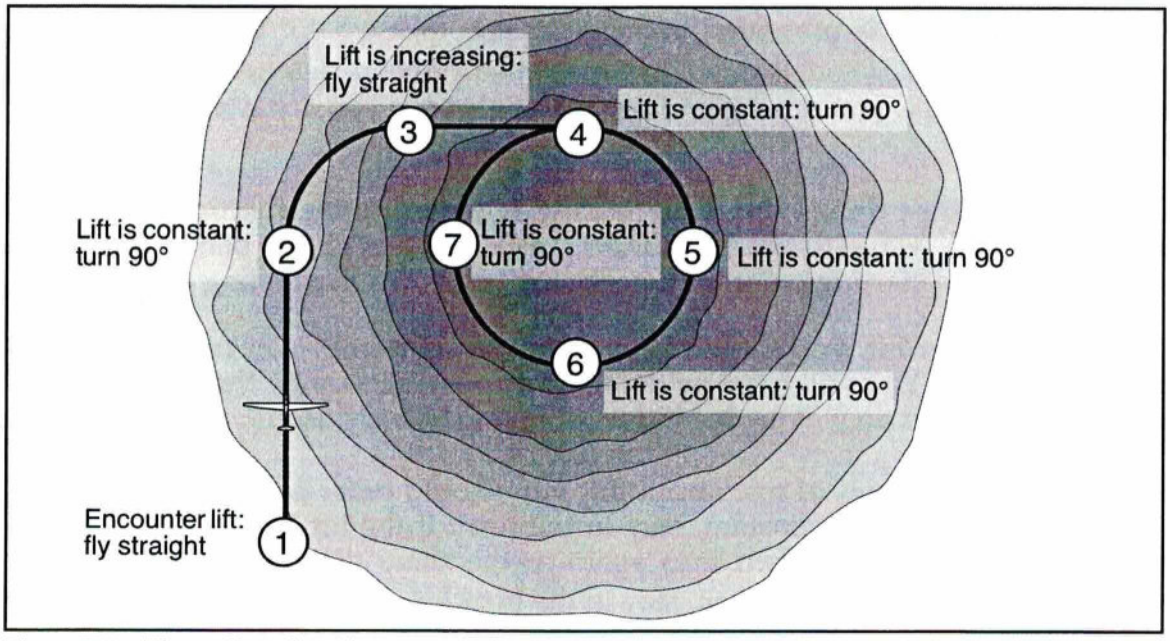


Figure 7.5 – Thermaling algorithm as applied to an ideal thermal. The darker areas indicate stronger lift.

The pilot then enters a 90° turn to the right. During the turn the lift is increasing, so the pilot levels out at ③ and flies straight. The lift peaks again at ④, so the pilot enters another 90° turn in the same direction. At ⑤, the lift is constant, so the pilot stays in the turn. As long as the lift stays relatively constant, the pilot maintains the turn.

About half the time, you will make the first turn in the wrong direction, away from the thermal. Following the previous thermaling algorithm will bring you back to the center. In Figure 7.6, the pilot encounters lift at ① and makes a turn to the left when the lift peaks at ②. However, the core of the thermal is in the other direction, so after the 90° turn, the lift has dropped off. The pilot would perceive this as a sinking feeling. The pilot realizes that the lift is decreasing and therefore, at ③, following the algorithm, continues the turn for another 180°.

Note that this turn does not bring the pilot right back into the strong lift, but by the end of the turn, the lift will start to increase. The pilot will level out at ④ and continue flying straight until the lift peaks at ⑤. The pilot then makes a turn in the same direction as the original turn. As you can see, 90° into this turn, at ⑦, the lift has stayed relatively constant, so the pilot will continue to turn.

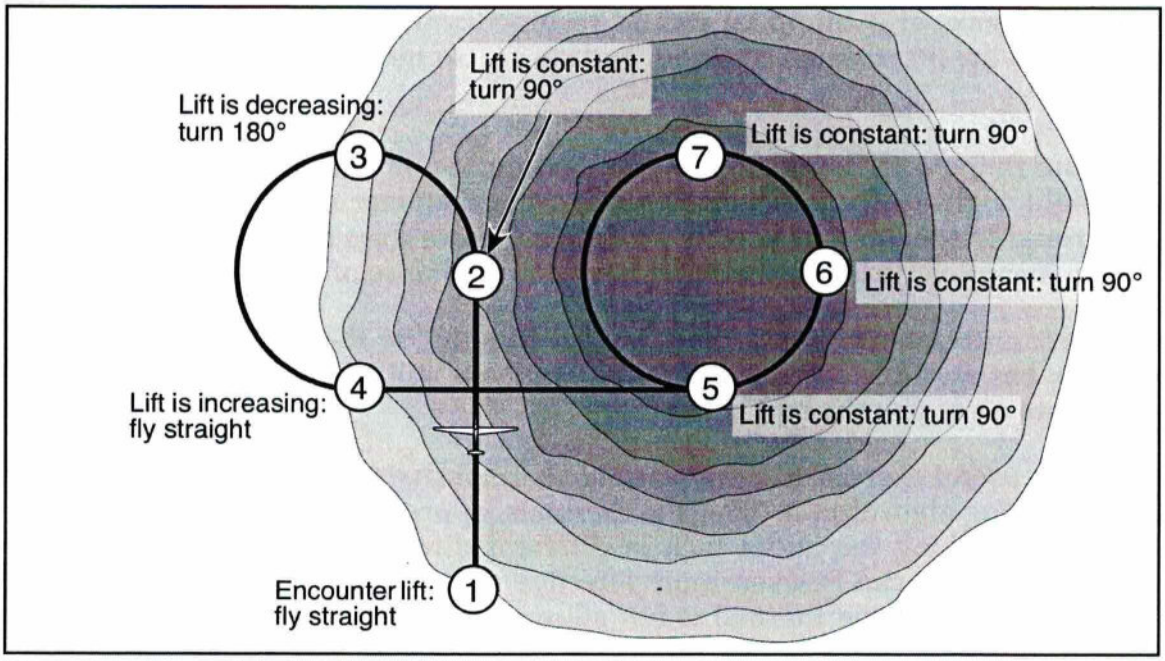


Figure 7.6 – Thermaling algorithm applied when the initial turn is made in the wrong direction

The same algorithm can be applied when you are in a thermal but are not centered. You know this is the case when you are getting strong lift on one side of the thermal and weaker lift, or sink, on the other.

The glider shown in Figure 7.7 is in a thermal but is not centered. The pilot will notice that the lift is decreasing at ①, increasing at ②, and peaks where the glider is shown.

The pilot should level the wings as the lift is increasing at ②. Notice that the pilot should *not* level the wings when the lift is at its maximum.

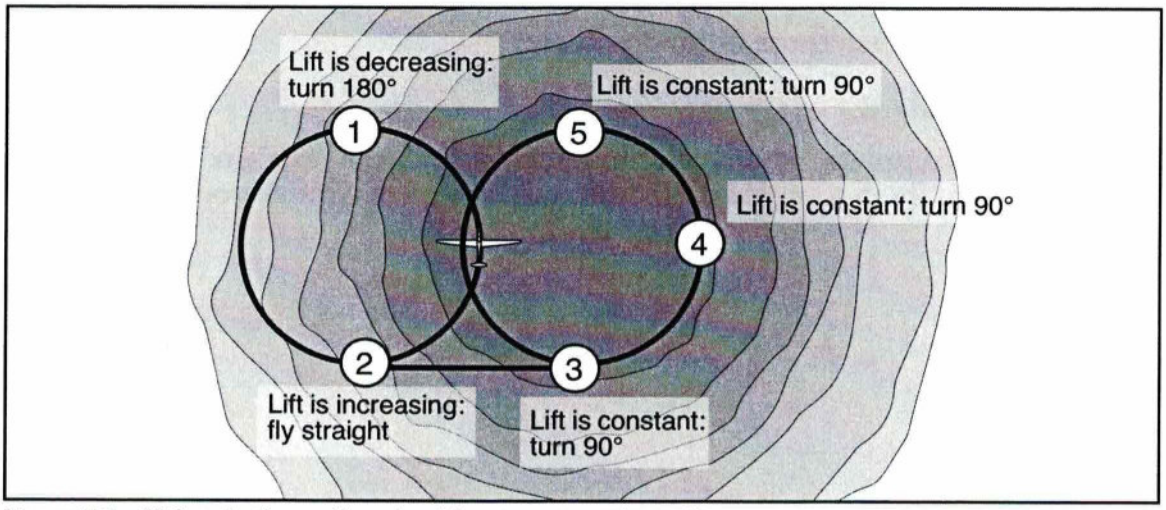


Figure 7.7 – Using the thermaling algorithm to center a thermal

As the lift peaks at ③, the pilot should resume turning in the original direction. At ④ and ⑤ the lift remains constant, and strong, so the pilot should continue the turn.

If you are flying a 45° bank angle while circling, it will take you about 6 seconds of straight flight to fly a distance equal to the diameter of one of your circles. Thus, roughly speaking, if you fly straight for more than 6 seconds, you will be flying in completely different air and have a high chance of losing the thermal.

If you are encountering more than one "good side" of the thermal, the thermal probably has multiple cores. If this is the case, you will have to experiment to see which core gives you the best climb rate.

It can be a useful exercise to draw various thermal shapes on paper, and then use the thermaling algorithm to "fly" the thermals, approaching them from different angles and making the initial turn in different directions to see how the algorithm works. This can be even more effective when done with a partner, where the person "flying" the thermal is not allowed to look at the paper, but is only given feedback about whether the lift is increasing, decreasing, or remaining constant.

Common Errors

- Using too shallow of a bank angle so that your turn radius is too large for you to stay in the thermal
- Flying too fast in the thermal
- Failure to maintain a constant bank angle and airspeed
- Failure to continuously clear for traffic while thermaling
- Failure to climb when those around you are!

Completion Standard

This lesson is complete when you understand and can explain how to find thermals, how to fly in a gaggle of gliders, and how to maximize your climb rate.

7.2 Mountain Wave

Purpose

If you are lucky enough to fly in a mountainous region, you may experience the strong, extensive, and incredibly smooth lift created by mountain waves. In this lesson, you will learn about the hazards and methods of flying in mountain wave lift.

Procedure

Wave lift is formed when high winds are deflected upward by a mountain range or ridge. If the wind strength increases with altitude, mountain waves can form. The secondary or tertiary waves can be stronger than the primary wave. The weather conditions that produce wave lift are explained in Section 6.11 of the *Glider Pilot's Handbook of Aeronautical Knowledge.*

Hazards of Wave Flying

Wave flights usually involve high altitudes and high winds. These conditions pose unique dangers that you should understand before attempting your first wave flight.

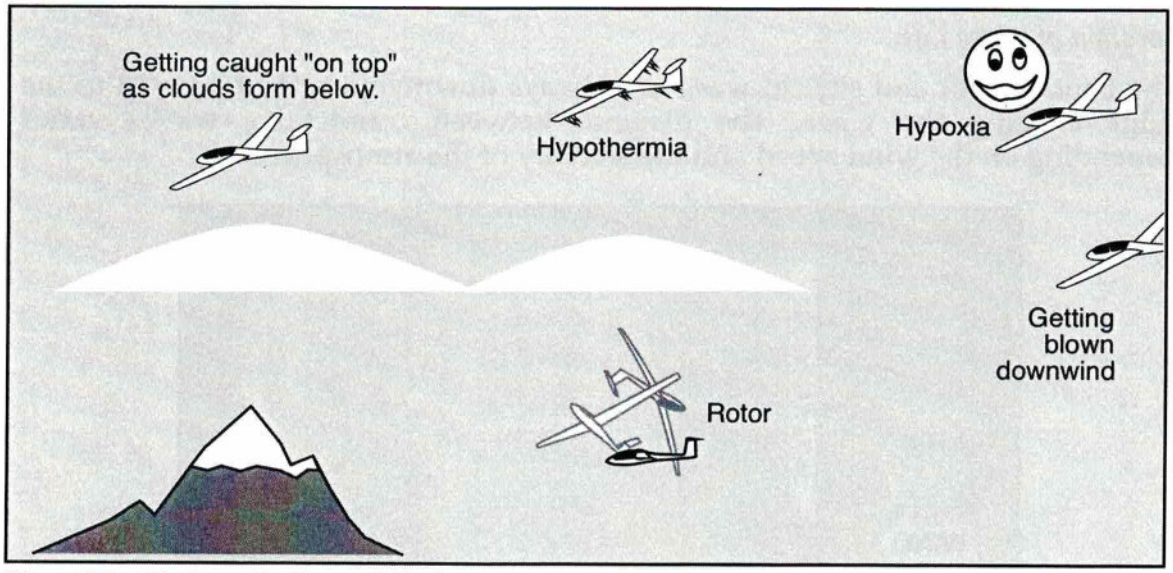


Figure 7.8 – The hazards of wave flying!

Among the dangers posed by the high winds, the most dramatic is the rotor usually found below each peak of a wave. Rotors are characterized by strong wind gradients with changes in direction of 180° common; they can be quite turbulent. If you find yourself in or near a rotor, you should fly fast enough to maintain control, but slow enough to avoid over-stressing the glider.

Because of the increasing winds at higher altitudes, it is possible to find yourself having to speed up more and more just to maintain position over the ground. If you start to approach the never-exceed speed of the glider, you should descend

to avoid being blown downwind of the airport. Remember that at high altitudes the true airspeed is significantly higher than the indicated airspeed. Be careful not to exceed the limits of your glider.

Another hazard can be the formation of clouds beneath you, which can block your view of the ground. If there is any indication that clouds below you are starting to close up, you should immediately descend below them. If you are at high altitude, it can take considerable time to descend to a level below the clouds.

Two other hazards are associated with the high altitudes of wave flying. The first is hypothermia. Make sure you dress appropriately for the conditions of extreme cold that you will encounter. Your ability to think clearly and your coordination both deteriorate rapidly as you become hypothermic. If you get so cold that you start to shiver uncontrollably, you should descend immediately.

Hypoxia is the other, graver danger, especially when it is coupled with hypothermia. Make sure that your oxygen system is working before you leave the ground, and check often during the flight to verify that it is working. If you will be flying above 18,000 feet, you are strongly encouraged to have a backup oxygen system.

Location of Wave Lift

The bands of lift and sink in wave are always downwind of and parallel to the ridge creating the wave. The distance between consecutive waves varies depending on the wind speed and the stability of the atmosphere.

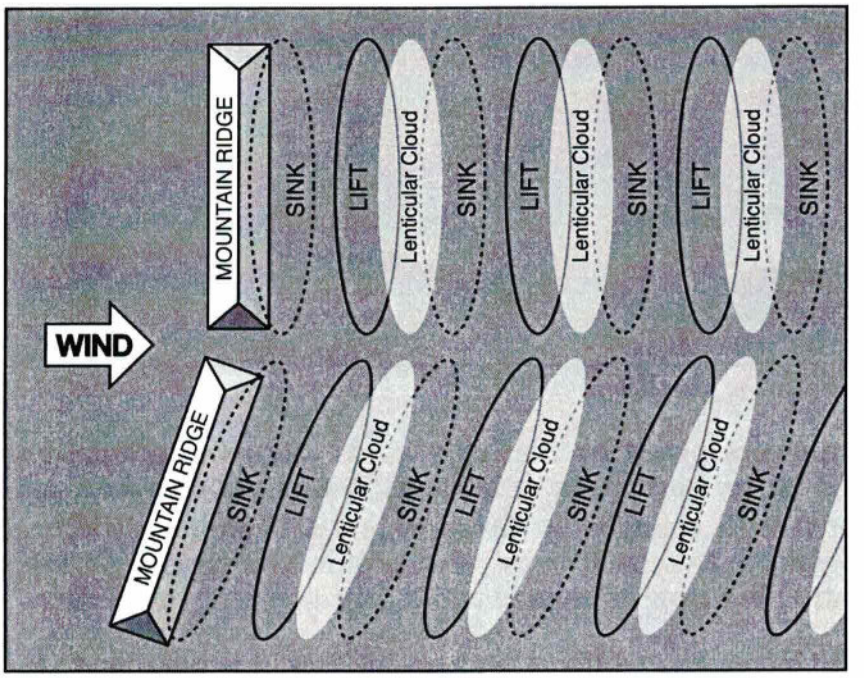


Figure 7.9 – Bands of lift and sink downwind of a mountain ridge. The lenticular clouds have lift under their upwind edge and sink under their downwind edge.

Connecting with the Wave

There are basically two options for getting into the wave. You can tow into it, or you can work thermal lift or rotor lift until you climb into it. Often there will be weak thermals just upwind of the rotor cloud. It may be possible to climb in one of these thermals up near the rotor. Upwind of the rotor, there can be choppy but workable lift. Instead of circling, it is often best to fly figure eights, always turning into the wind. If you can climb above the rotor and into the wave, you will be rewarded with smooth, consistent, extensive lift.

After you connect with the wave, you can explore upwind and downwind to find the strongest lift. Keep in mind that because of the high wind speeds it is easy to drift too far downwind and find yourself in sink.

Working Wave/Rotor Lift

Once you find the strongest lift, you should track parallel to the ridge creating the wave. While working wave lift, you will be crabbing significantly. It is not unusual to use crab angles greater than 45° while flying in wave.

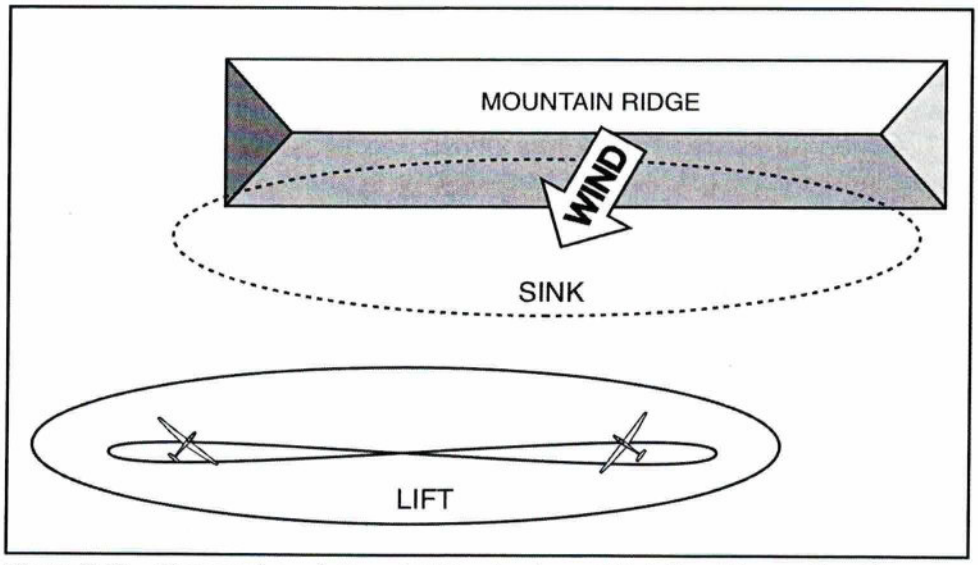


Figure 7.10 – Use a crab angle to maintain a track parallel to the ridge creating the wave.

If the lift starts to decrease, either you have flown out of the end of the lift, or you have flown too far upwind or downwind. Unfortunately, if there are no lenticular clouds to mark the location of the wave, it can be difficult to determine which of these has occurred.

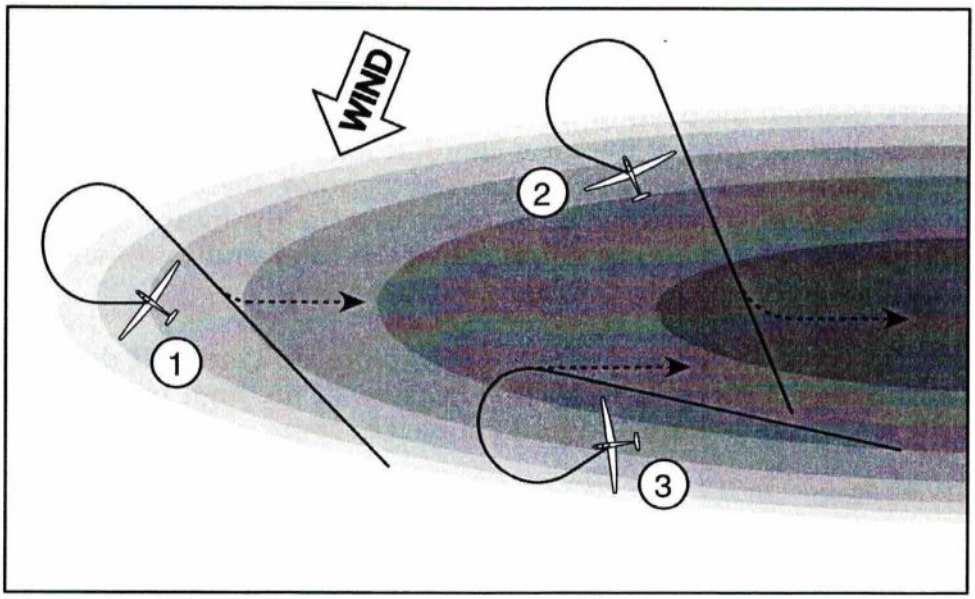


Figure 7.11 – If the lift starts to decrease, you have either flown out the end of the lift ①, flown too far upwind ②, or too far downwind ③. A 270° turn upwind can help you reconnect with the lift.

Most pilots use too little crab angle when first flying in wave. They therefore are blown downwind and out the backside of the lift, as has happened to glider ③ in Figure 7.11. Glider ② in this figure has flown too far upwind, and glider ① has flown out the end of the lift. Notice that in any of these cases, if the pilot flies a gentle 270° turn upwind (as shown by the solid lines), at some point the glider will fly back into the lift. The pilot then simply needs to re-establish a track parallel to the ridge (as shown by the dotted lines).

Finding and staying in wave lift can be extremely challenging, especially when there are no clouds to mark its location.

Common Errors

- Failure to prepare for a wave flight with the proper equipment and clothing
- Failure to track parallel to the ridge line
- Not recognizing or heeding the hazards of wave flying

Completion Standard

This lesson is complete when you can explain the conditions that cause mountain wave, the hazards associated with wave flying, the location of the lift and sink associated with wave, and the method of working wave lift.

7.3 Ridge Lift

Purpose

Ridge lift is probably the simplest and easiest to understand type of lift. However, it presents certain risks because it occurs near the ground. In this lesson, you will learn how to safely use ridge lift.

Procedure

Ridge lift is created when wind is forced to rise over an obstacle. Birds can often be seen soaring the ridge lift produced by a house or a building. Gliders, however, need something more substantial, like a mountain or ridge line.

The strongest lift occurs when the wind is perpendicular to the ridge line. The best lift is usually located in an area slightly upwind of the steepest slope of the ridge. Unless thermals are present, there will be no usable lift over the crest of the ridge. Downwind of the ridge, there will be sink and often strong turbulence.

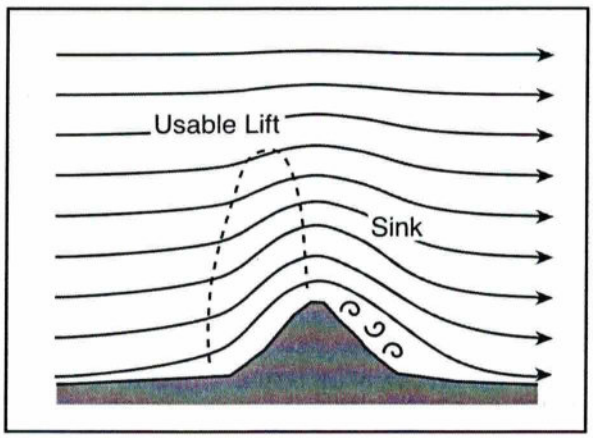


Figure 7.12 – When the wind blows across a ridge, there will be lift over the upwind face of the ridge and sink over the downwind face. Often there will be turbulence downwind of the top of the ridge.

When flying in ridge lift, always maintain a safe margin above the stall speed. It is unlikely you could recover from a stall or spin at low altitude.

While ridge lift is relatively consistent, never put yourself in a situation where your safety would be compromised if the lift turns out not to be present. Many factors could cause a sudden change in the wind speed or direction, which could interrupt the lift.

The strength of ridge lift varies with the height of the ridge. The minimum acceptable height of a ridge is usually determined by the distance from the ridge to the nearest safe landing area. Although a small ridge only 200 or 300 feet high can produce enough lift to sustain a glider, you should always have enough altitude to glide to the landing area and fly a pattern should the lift cease.

When you approach a ridge expecting to work ridge lift, do not head directly toward the ridge. Instead, approach it at no more than a 45° angle. This gives you time to turn so that you track along the ridge, crabbing into the wind, without being blown into or behind the ridge. Remember that you will be traveling quite fast over the ground because of the tailwind.

At high altitudes, you should be especially careful when heading toward a ridge. Your turning radius will be much greater for a given indicated airspeed and bank angle due to the lower air density.

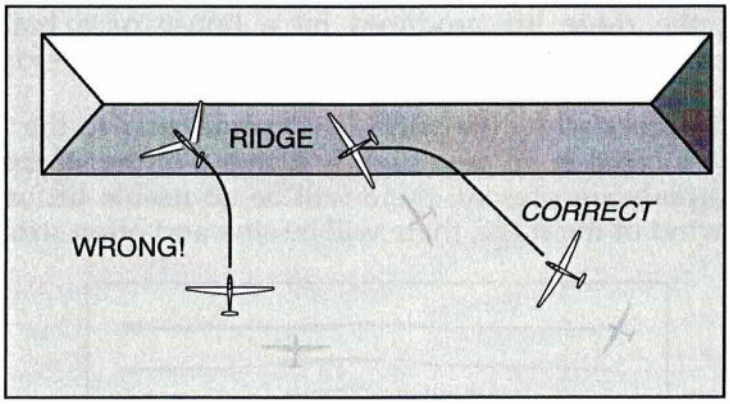


Figure 7.13 – Approach the ridge at an angle of less than 45° to avoid being blown behind or into the ridge.

Once you are in the ridge lift, track parallel to the ridge using a crab angle. All turns should be made away from the ridge, into the wind.

Often there will be several gliders on a ridge where there is ridge lift. Because the lift is confined to a relatively small area, each pilot must carefully look for other traffic and observe the right-of-way rules of ridge flying.

When overtaking another glider, you should always pass on the inside, between the glider and the ridge. This way, if the other glider turns, it won't turn into you.

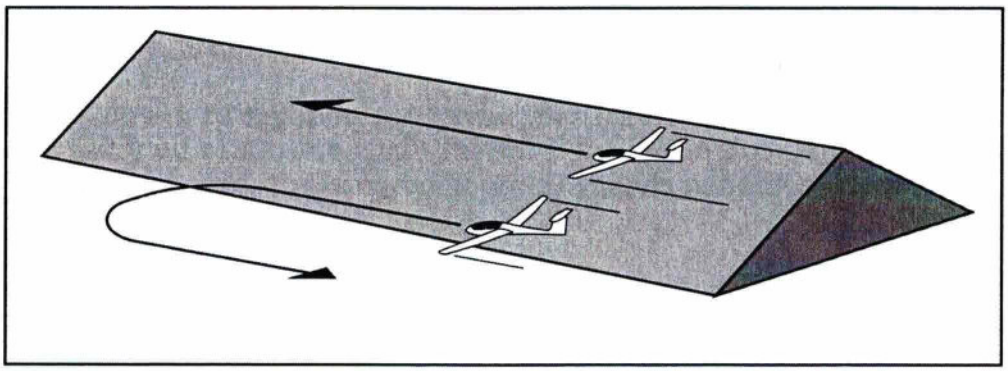


Figure 7.14 – When passing another glider on the ridge, fly between the glider and the ridge.

Do not fly directly under another glider, since the pilot will not be able to see you at all. If you are overtaking the glider, slow down and climb, and pass the glider on the inside. If necessary, reverse direction until you have the altitude to safely pass.

If you are approaching another glider head-on, you should both give way to the right. Realize that the glider closer to the ridge may not be able to veer to the right because of the terrain. In this case, the other glider should alter course to provide enough clearance.

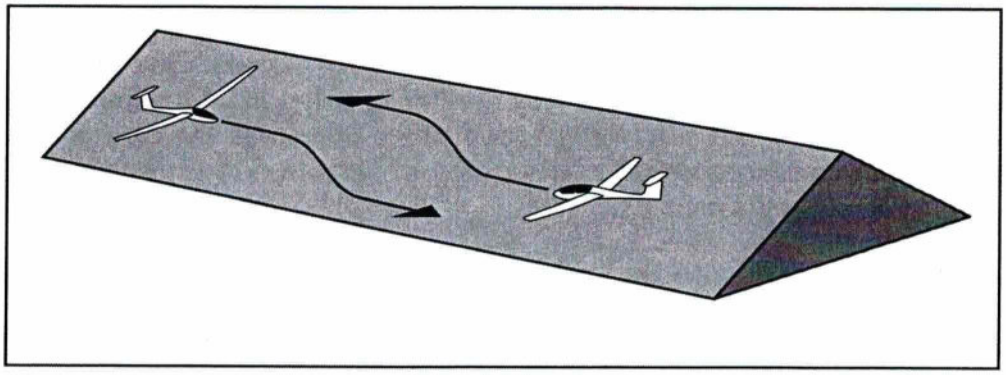


Figure 7.15 – Both gliders should veer to the right when approaching head-on.

Common Errors

- Failure to make all turns away from the ridge (i.e., into the wind)
- Failure to maintain a safe margin above stalling speed
- Failure to obey ridge right-of-way rules
- Flying too far back, into the sink or turbulence behind the ridge

Completion Standard

This lesson is complete when you understand and can explain how ridge lift is created, how to climb in ridge lift, and how to apply the right-of-way rules of ridge flying.

7.4 Convergence/Shear

Purpose

When two air masses collide, they have nowhere to go but up. In this lesson, you will learn how to use the lift from a convergence or shear line.

Procedure

In many parts of the country, especially on the West Coast, independent air masses will move inland from the ocean. If these air masses collide, they form a convergence zone, sometimes referred to as a "shear line" because of the significant difference in wind direction between the two air masses. One mass usually rides up over the other, creating lift very similar to ridge lift. The zone can move about during the day, and often migrates further inland as the day progresses. The formation of convergence lift is discussed in Section 6.12 of the *Glider Pilot's Handbook of Aeronautical Knowledge.*

Convergence lift is easiest to find when there is enough moisture for clouds to form over the convergence line. When there are no clouds, a convergence line can sometimes be identified by differing visibilities in the two air masses. This is especially true if one of the air masses has traveled over a populated or industrial area.

Some convergence lines create large areas of relatively weak lift. If this is the case, you can fly back and forth parallel to the shear to gain altitude.

Other times, the convergence can trigger thermals, creating a narrow band of strong but concentrated lift. In this case, it is usually best to work the convergence zone like a thermal, circling in the strongest lift.

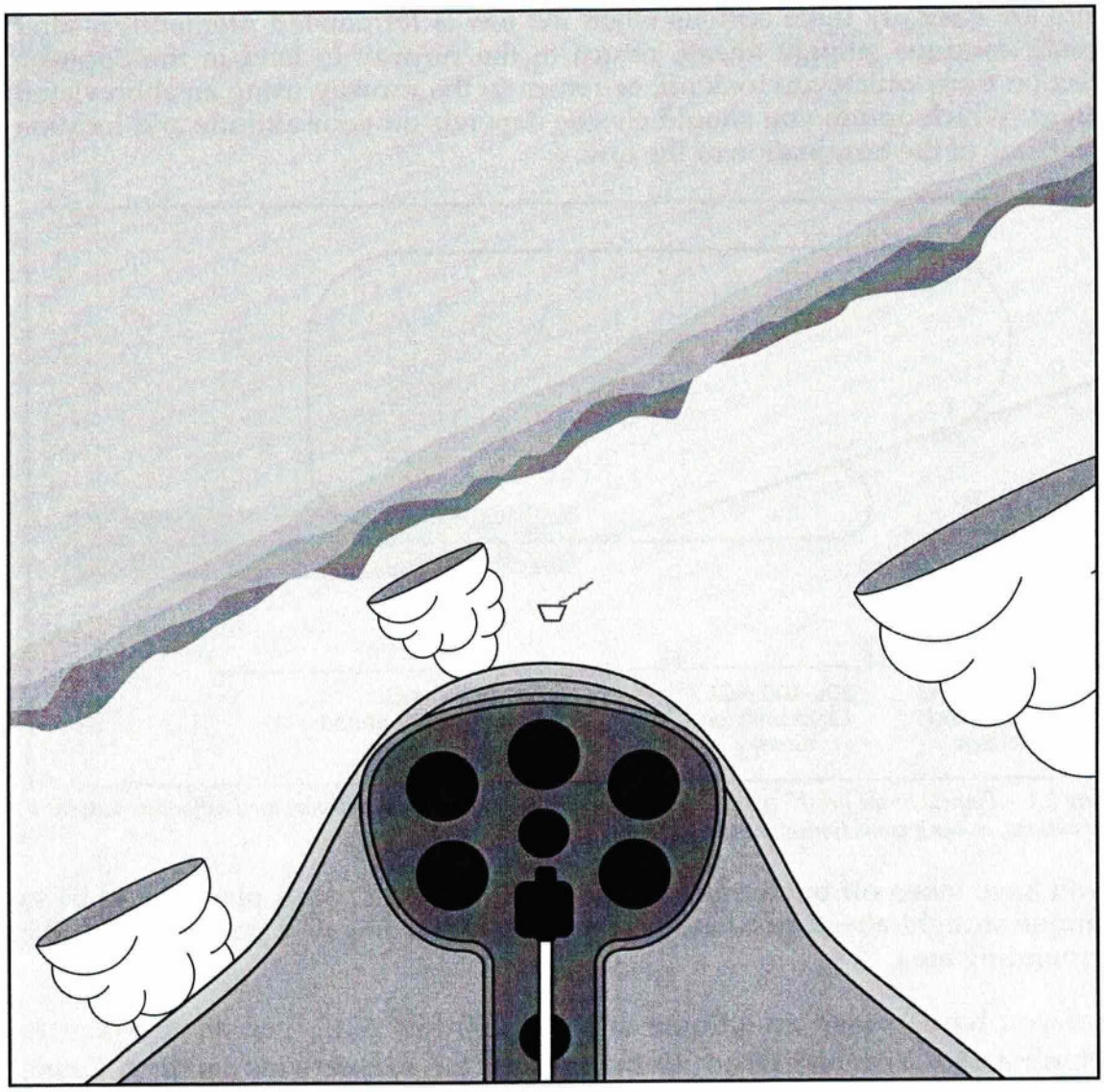
Your instructor will inform you of any convergence zones that tend to form in and around your training area.

Completion Standard

This lesson is complete when you can explain the conditions leading to convergence lift and the methods for working it.

CHAPTER 8: EMERGENCY PROCEDURES

Sometimes things go wrong. Perhaps you hit severe turbulence while on tow, and the towrope breaks. Or you find yourself in an unusual attitude as the result of an unexpected encounter with a rotor. You are much more likely to successfully recover from these situations if you have practiced them during your training. In this chapter, you will learn how to cope with various emergency situations.



8.1 Introduction to Premature Aerotow Release

Purpose

In the event of a premature aerotow release (i.e., a rope break or tow hook malfunction), you may only have a split second to react. It is important that you have a plan of action, so that all you have to do in an emergency is carry out the plan. In this lesson, you will learn how to plan for premature aerotow releases. In later lessons you will practice executing your plan.

Procedure

Rope break procedures vary from airport to airport. What is given here is an overview of the general options. Make sure you understand the specific procedures used at your airport.

There are basically three options when the tow is terminated prematurely after takeoff: continue straight ahead, return to the runway to land in the opposite direction from which you took off, or return to the runway using an abbreviated pattern. Which option you should choose depends on your altitude and location at the time of the termination of the tow.

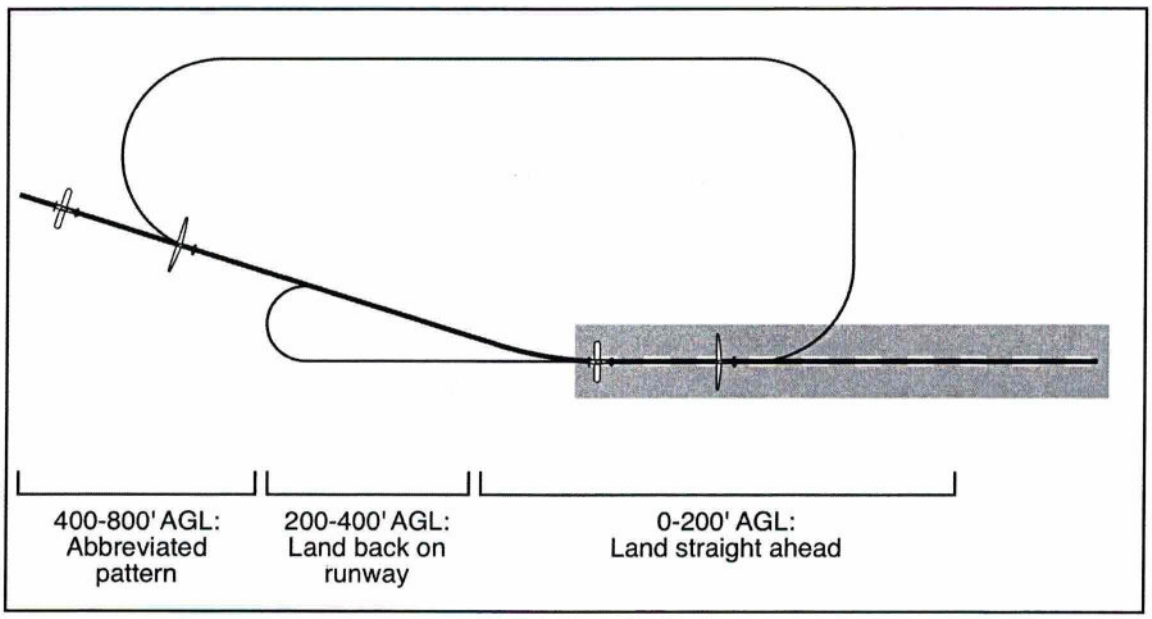


Figure 8.1 – Typical "rope break" plans. The rope break procedure at your airport may differ due to terrain, obstructions, or equipment limitations.

If you have taken off but are below about 200 feet AGL, your plan should be to continue straight ahead and land on the remaining runway if possible, or in the surrounding area.

Once you have passed an altitude of about 200 feet AGL, you should plan to perform a 180° turn and return to the runway for a downwind landing. Often, the tow pilot will veer to the downwind side of the runway after takeoff to make

it easier for you to make this turn should a rope break occur. You should not attempt a downwind landing if the winds are greater than about 10 knots. In higher winds, you should plan to land straight ahead.

Once you have reached an altitude of about 400 feet AGL, you should plan to do an abbreviated pattern. The size of the pattern depends on how high you are. As you climb higher above the ground, you can perform a normal, or near normal pattern.

You should make a plan for dealing with a premature termination of tow before each flight, taking into account the wind, traffic, and any other factors that might affect your plan. For the preflight checklist item "emergency plan", you should review your plan with your instructor.

You should monitor the radio during takeoff so that you will know of any traffic that might conflict with your rope break plans. For instance, if someone reports that they are taking off right after you, a 180° turn back to the runway may not be an option.

Your instructor will have you call out the transition points in your plan as you climb on tow. On a typical flight, you might make the following calls:

On runway:

"Land on runway."

Once landing on the runway is no longer an option:

"Land in field over the airport fence."

Once 200 feet AGL is reached:

"Perform a right 180° turn for a downwind landing."

Once 400 feet AGL is reached:

"Perform a left abbreviated pattern."

Once 1,000 feet AGL is reached:

"Normal pattern."

It is important to plan which direction you will turn in the event of a rope break. At low altitudes, hesitation or a turn in the wrong direction may eliminate a safe option.

Common Errors

- Failure to review your rope break plan before taking off
- Failure to announce when your options change as you gain altitude
- Failure to monitor the radio/airport environment for possible traffic conflicts

Completion Standard

This lesson is complete when on every flight, for each segment of the tow, you review your rope break plan with your instructor before takeoff, and call out the transition point in your plan as you climb on tow.

8.2 Simulated Rope Breaks

Purpose

In the previous lesson, you learned to make a plan of what to do in case the tow was terminated prematurely. In this lesson, you will practice executing that plan.

Procedure

The maneuvers required to recover from a rope break at low altitude are easy to perform on their own. However, if you do not have a plan, and the rope break catches you off guard, the surprise and shock can fluster you, significantly lowering your performance. The key to performing well when the rope breaks is to ALWAYS expect the rope to break.

General

Your instructor will demonstrate the different rope break procedures, and will warn you before pulling a rope break on you the first time. After that, you are on your own! Your instructor may surprise you at any time by pulling the release. Don't be surprised to have the rope "break" every time if you don't call your plan out loud!

When the rope "breaks", your first priority is to fly the glider. Get the nose down to maintain pattern airspeed, and then execute the plan that you have already made. It is important to note that at this point, there should be NO decisions to be made: you simply have to fly your plan.

If time permits, make a radio call to let other pilots know your intentions. Keep in mind, though, that your first priority is to fly the glider. Only use the radio if you have plenty of time to do so.

Do not open the airbrakes until you are sure that you will make the runway. On the other hand, do not forget to open the airbrakes when necessary to keep from overshooting the runway.

Do not fixate on a given spot on the runway. Just because you normally touch down "on the numbers" during a normal landing does not mean you have to extend a low downwind to touch down at the same point when the rope breaks. If you start getting low on downwind, turn base while you still have plenty of altitude to complete the turn safely!

Many students get nervous during a simulated rope break and try to get the glider on the ground as quickly as possible. Remember to bleed off your airspeed before touching down. Don't force the glider onto the ground before it is ready.

Landing Straight Ahead

Below about 200 feet AGL, your only option is to land straight ahead. If there is enough runway remaining, land on it. If not, you may need to make a turn to avoid obstacles, but keep the turn gentle and shallow.

If the rope breaks at this altitude, you should immediately adjust the pitch attitude to put the glider in a shallow descent. Do not allow the glider to climb, which will cause it to slow down. Do not pitch the nose down too much or you may cause the glider to dive into the ground.

If you must land off the runway, be sure to perform a low-energy landing, as discussed in Lesson 6.5.

180° Turn to a Downwind Landing

Between the altitudes of about 200 and 400 feet AGL, your plan should be to perform a 180° turn and return to the runway for a downwind landing. Before you take off, you should note the wind direction and plan to perform the turn into the wind.

If the rope breaks in this altitude range, you should immediately lower the nose to establish your pattern airspeed, then begin your turn back to the runway. A 45° bank angle will result in the glider losing the least amount of altitude in the turn.

Once you have brought the glider in-line with the runway, you can use your airbrakes and continue to perform a normal downwind landing. Keep in mind that if there is much wind, your ground speed will be higher than normal. Fly the correct airspeed and pitch attitude.

Abbreviated Pattern

Between the altitudes of about 400 and 800 feet AGL, your plan should be to perform an abbreviated pattern and return to the runway for a normal into-the-wind landing.

You should fly the abbreviated pattern using the same angles that you use for a normal pattern. Just make sure you allow yourself enough room to perform the turns from downwind to base and base to final. You should turn base at no lower than about 300 feet AGL.

Do not worry about having to end up at the "normal" place on the runway. If you are getting low on downwind, turn base and final when you still have plenty of altitude to maneuver.

At altitudes above 800 feet AGL, you should be able to fly a normal pattern.

Common Errors

- Failure to make or communicate your rope break plan
- Failure to maintain the proper airspeed

- Failure to maintain coordinated flight
- Failure to execute the stated plan
- Fixating on the "normal" aim point

Completion Standard

This lesson is complete when you can execute a safe landing after a simulated rope break from any altitude while maintaining the appropriate airspeed within +10/–5 knots.

8.3 Rock Off

Purpose

If the tow plane malfunctions, the tow pilot will indicate to the glider pilot to release by giving the "rock off" signal. In this lesson, you will learn to recognize and properly react to the rock off signal when given by the tow plane.

Procedure

This lesson is simple. If the tow plane rocks its wings, you pull the release. Since you already have a plan for a premature termination of the tow, you will then simply fly that plan. Be sure to keep your airspeed up by immediately lowering the nose after releasing.

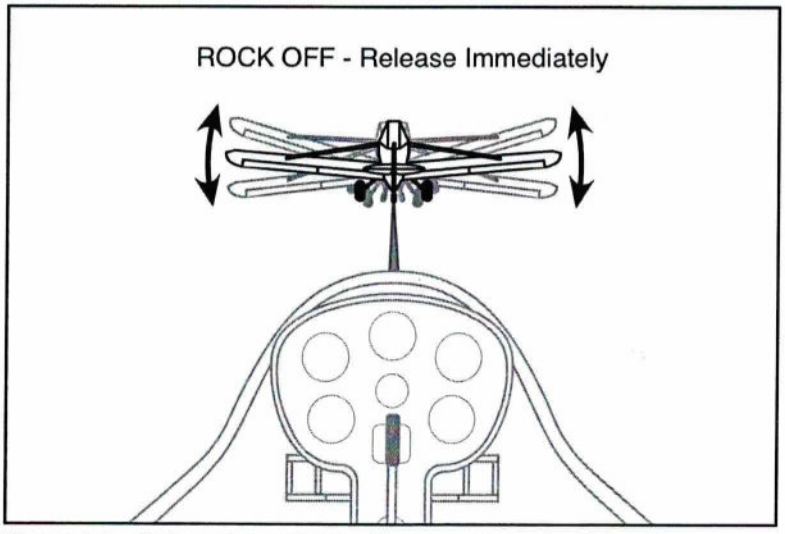


Figure 8.2 – Release immediately if you see the rock off signal.

Your instructor will have the tow pilot give the rock off signal sometime during a tow. You may or may not be warned that the rock off will occur. From the movement of the tow plane it should be clear that the tow pilot is rocking the wings, and that the movement is not the result of a gust.

Common Errors

- Failure to release when the tow plane rocks its wings
- Failure to execute the predetermined rope break plan

Completion Standard

This lesson is complete when you react properly to the rock off signal by immediately releasing the towrope and executing your rope break plan.

8.4 Tow Plane Power Loss During Takeoff

Purpose

Should the tow pilot have to abort a takeoff due to a loss of power or another problem, you must react quickly to avoid overtaking and colliding with the tow plane. In this lesson, you will learn how to react if the tow plane loses power during takeoff.

Procedure

The first indication that the tow plane has lost power will probably be slack forming in the towrope. If you notice this happen, you should release immediately and veer to the right if necessary, just as you would when performing a normal release from tow at altitude. The tow plane will try to veer to the left.

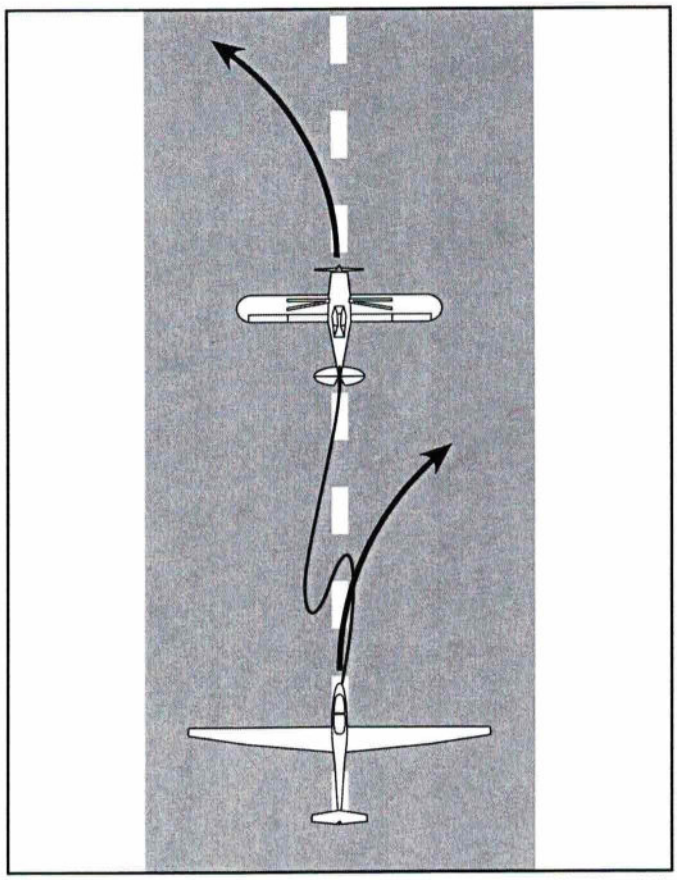


Figure 8.3 – If the tow plane loses power on takeoff, the glider should veer to the right, and the tow plane to the left.

You should open your airbrakes and use the wheel brake to get the glider stopped as soon as possible. The tow pilot will move to the left to give you room in case you have to pass the tow plane.

Common Errors

- Failure to pull the release as soon as slack is noticed in the towrope
- Failure to veer to the right if necessary after release
- Failure to use the wheel brake to get stopped

Completion Standard

This lesson is complete when you can explain the symptoms of a tow plane power loss on takeoff, and can execute (or describe) the proper reaction.

8.5 Tow Plane Power Loss at Altitude

Purpose

If the tow plane loses power in flight during the tow, it will start to descend. Because the glider is so much more efficient than the tow plane, it will quickly overtake it. In this lesson, you will learn how to recognize when the tow plane has lost power during a tow, and how to react to avoid a collision.

Procedure

If the tow plane loses power during the tow, you will probably notice the tow plane starting to descend. If you remain in proper tow position (i.e., keep the tow plane on the horizon), you will start to overtake the tow plane, and slack will develop in the towrope. If this happens, you should release and quickly turn right. You must do this immediately to keep from colliding with the tow plane. This is one case where you do not want to take time to look for other traffic before you turn. Your primary concern is to first avoid the tow plane.

After you release, you will need to continue avoiding the tow plane, which will probably have to land before you do.

Common Errors

- Failure to recognize that the tow plane has lost power
- Failure to release the towrope and maintain sufficient separation between the glider and the tow plane

Completion Standard

This lesson is complete when you can quickly recognize when the tow plane has lost power and take immediate action to avoid overtaking it.

8.6 Simultaneous Release Failure

Purpose

In this lesson you will learn two different ways to deal with the simultaneous failure of both the glider and tow plane release mechanisms.

Procedure

You have two options if both the glider and tow plane are unable to release the rope. You can intentionally break the rope, or you can land while on tow.

Breaking the Rope

When intentionally breaking the rope, you want to make sure that the glider is in a position directly behind the tow plane, so that the rope cannot hit the glider or foul the control surfaces.

To break the rope, you should put slack in the line by climbing (and moving to the side slightly to be able to view the rope), and then quickly descending back into position behind the tow plane. When you quickly descend, slack should develop in the rope. When you are back in position (do not descend below the tow plane) open the spoilers to increase the drag on the glider. Make sure you do not allow the glider to descend; maintain altitude by raising the nose of the glider. Make sure the nose of the glider is pointing directly at the tow plane to maximize the shock as the rope comes tight. The rope should break, but if not, try it again with more slack.

If the rope breaks at the tow plane end, you may want to start a slight climb as soon as it breaks to make sure it passes safely beneath you. When coming in to land, make sure that you give yourself extra room to clear any obstacles, since you may be trailing a 200 foot length of rope.

Landing on Tow

If you decide to land on tow instead of breaking the towrope, you will first have to descend along with the tow plane. The glider will have a tendency to catch up to the tow plane on descent, creating slack in the towrope. To avoid this, you should open your spoilers to increase the drag on the glider. Try to keep the spoilers in a constant position, and let the tow pilot determine the descent rate by adjusting the throttle.

You will find that in descending tow, the tow plane's wake will be higher than normal. It is advisable to move to low tow position during the descent and landing.

You should maintain a constant spoiler setting throughout the approach and flare. As the tow plane levels out prior to touchdown, you can gently open the spoilers to force the glider to touch down before the tow plane. Once the tow plane touches down, use the wheel brake to keep from overtaking it. The tow plane will steer to the left, and you should veer to the right side of the runway.

Completion Standard

This lesson is complete when you can describe how to intentionally break the towrope and how to land while on tow.

8.7 Spiral Dive Recovery

Purpose

A spiral dive can occur when the glider is banked too steeply. If a timely recovery is not initiated, the airspeed and load factor can rapidly increase to the point where the glider will be damaged. In this lesson, you will learn how to recognize and safely recover from a spiral dive, and to distinguish between a spiral dive and a spin.

Procedure

At a safe altitude, and after clearing the area, your instructor will have you enter a steep-banked, descending turn, and allow the airspeed to increase. As the airspeed approaches the maneuvering speed, you will recover by first relaxing the back pressure on the stick, and then leveling the wings. Once the wings are nearly level, you can then pull out of the resulting dive.

It is important to relax the back pressure and level the wings first, before trying to raise the nose. Pulling back on the stick while in the spiral dive will increase the load on the glider without slowing it down. The excess airspeed and load can damage the glider.

Note that in a spiral dive, the load and airspeed, and therefore the noise level, increase rapidly. Compare that to a spin, where the airspeed is constant, the G-forces low, and the noise level relatively low and constant.

Common Errors

- Failure to clear the area
- Using too much control deflection (pulling too many G's) when exceeding the maneuvering speed of the glider
- Trying to initiate the recovery by pulling back on the stick instead of leveling the wings

Completion Standard

This lesson is complete when you can recognize and recover from a spiral dive, and can distinguish between a spin and a spiral dive.

8.8 Unusual Attitude Recovery

Purpose

Severe turbulence from strong thermals, rotor, or the wake of a large aircraft could upset a glider, placing it in an unusual attitude. In this lesson, you will learn to recover from unusual attitudes without over-stressing the glider.

Procedure

There are two rules to remember when recovering from unusual attitudes. If the nose is up, get it down, and then level the wings. If the nose is down, level the wings first, and then raise the nose.

The reason you want to get the nose down if it is high is to avoid a stall. Get the nose down first, decreasing the angle of attack, then worry about getting the wings level.

If the nose is low, there is a danger of entering a spiral dive, and over-speeding and over-stressing the glider. When the nose is low, you want to get the wings level first and then recover from the dive.

In the extreme case of the glider being rolled upside down, you should strive to keep the nose above the horizon. If the glider is completely inverted, this will require moving the stick very far, if not all the way, forward. Unless you are very close to the ground, do not worry about stalling the glider; most gliders will quickly roll right side up if they stall while inverted. Once the nose is above the horizon, use the ailerons (don't worry about coordinating with the rudder) to roll the glider right side up. Do not try to recover from inverted flight by pulling back on the stick (performing half of a loop). The glider will pick up too much speed during the recovery.

In this lesson, your instructor will place the glider in an unusual attitude then give control of the glider back to you. You should recover to level flight without subjecting the glider to excessive airspeeds or G-loads.

Common Errors

- Trying to level the wings first when the nose is high
- Applying back stick before leveling the wings when the nose is low
- Using too much control deflection (pulling too many G's) when exceeding the maneuvering speed of the glider

Completion Standard

This lesson is complete when you can recognize and recover from any unusual attitude using smooth and coordinated control inputs, without losing excessive altitude or exceeding the flight limitations of the glider.

8.9 Intercept Procedures

Purpose

If you stray in to prohibited, restricted, or a national security airspace, you may be intercepted by a military or law enforcement aircraft. In this lesson, you will learn how to respond to the intercepting aircraft.

Procedure

If you are ever intercepted, the intercepting aircraft will fly along side you, and rock its wings. You should acknowledge that you understand that you have been intercepted by rocking your wings. The intercepting aircraft will then initiate a slow turn in the direction of the desired heading. You should follow.

If a military or law enforcement aircraft flies near or next to you, but does not rock its wings, then you have not been intercepted.

If you are intercepted, you should contact ATC on 121.5, and give them your aircraft type (glider), your registration number, and your position. If you have a transponder, you should set it to 7700 unless directed otherwise by ATC. If the directions given to you by ATC, or any other agency, conflict with the instructions given by the intercepting aircraft, follow the instructions given by the intercepting aircraft, but inform ATC.

If the intercepting aircraft performs a breakaway, consisting of an abrupt 90° or more climbing turn, you have been released, and may proceed. You should rock your wings to acknowledge.

If the intercepting aircraft flies over an airport and lowers its landing gear, you should land at the airport.

Completion Standard

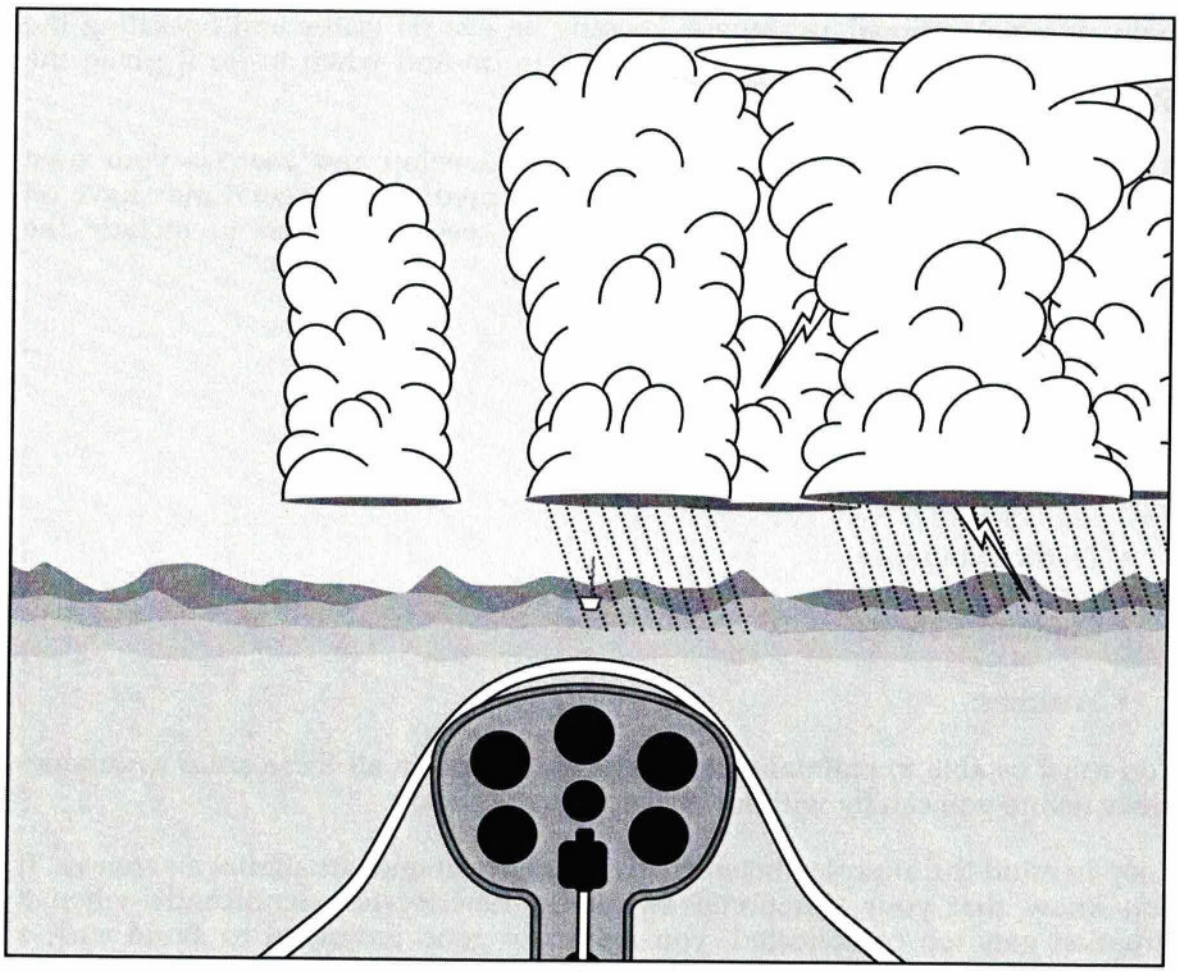
This lesson is complete when you can explain intercept signals and procedures.

CHAPTER 9: AERONAUTICAL DECISION MAKING

The lessons in this chapter are intended to give you a chance to apply the knowledge you learned in Chapter 16: Aeronautical Decision Making, of the *Glider Pilot's Handbook of Aeronautical Knowledge*. They will also give your instructor the opportunity to evaluate your aeronautical decision making skills.

During your lessons, your instructor will constantly be evaluating your aeronautical decision making (ADM). Sometimes your instructor will set up a situation specifically to test your ADM process. Other times you will be evaluated on how you deal with situations that naturally arise in the course of your training.

Keep in mind that although there are "completion standards" listed for each lesson in this chapter, you should continually strive to improve your ADM skills.



9.1 Situational Awareness

Purpose

As a glider pilot, you need to be aware of both the factors currently affecting your flight and those that could affect your flight in the near or not so near future. By simply being aware of a developing situation, you can often take action to prevent a problem from turning dangerous. In this lesson, your instructor will help you to evaluate and improve your situational awareness.

Procedure

During your first flight lessons, you may find that performing basic tasks such as maintaining proper pitch attitude and keeping your wings level are all that you can concentrate on. As you become more comfortable and skilled at flying the glider, you will be able to develop increasing awareness of your environment.

Before you can solo, you must have enough situational awareness to keep yourself from getting into any situations requiring more skill than you possess. During the early part of your training, your instructor will be responsible for maintaining situational awareness; keeping an eye on traffic and operating the radio for you, as well as telling you what to do and when to do it given the situation at hand.

As you progress in your training, you must develop and exercise your own ability to perceive a situation, interpret it, and predict the effect it may have on your flight. Your situational awareness will need to expand to include the following areas:

- Flight planning
- Controlling the glider
- Glide slope management
- Traffic avoidance
- Communications
- Weather

You must be able to maintain situational awareness in all these areas simultaneously before you can fly without instructor supervision.

Keep in mind the interplay between good judgment and situational awareness. If you know that your situational awareness deteriorates significantly when a situation gets too complicated, you must use good judgment to avoid such a situation. This could mean, for instance, deciding not to fly when traffic around the airport is heavy, or only flying on days with benign weather.

Common Errors

- Failure to have a plan before starting your flight (tow height, tow location, maneuvers to practice, pattern entry altitude, etc.)
- Failure to notice when the glider is departing from the desired flight path, attitude, or airspeed
- Failure to return to the airport with sufficient altitude for a normal pattern
- Failure to notice traffic that may be a collision hazard
- Failure to acknowledge or respond to radio calls
- Failure to notice when weather conditions (wind, clouds, rain, etc.) have changed
- Failure to perceive a situation that could jeopardize the safety of your flight
- Failure to properly interpret information perceived
- Failure to predict the impact of a situation on your flight

Completion Standard

This lesson is complete when you have developed and can consistently maintain sufficient situational awareness to simultaneously control the glider, monitor traffic, communicate, and evaluate the weather.

9.2 Judgment

Purpose

In a sport like soaring, the consequences of a poor decision can be harsh. In this lesson, your instructor will help you to develop and evaluate your ability to make good decisions.

Procedure

You and your instructor will discuss some personal limits. For example, how low are you willing to try to thermal before committing to landing? How much of a safety factor will you use in your glide slope management calculations? What is the strongest crosswind that you will fly in? What is the lowest visibility that you will fly in? When flying cross-country, will you fly airport to airport, or is an off-field landing an acceptable alternative?

In the course of your training, your instructor will help you to evaluate some of your decisions. You will apply a systematic approach to decision making to discuss the benefit, hazards, risks, consequences, preventions, and precautions relating to your situation. You will consider the values that motivated your decision, and any obstacles or attitudes that may have clouded your judgment. Your instructor will also discuss strategies for solidifying your values and improving your judgment.

Keep an open mind during these discussions. While experience pilots may seem to you to be overly conservative, they have developed this attitude by observing, either personally or through the experience of others, the severe consequences of poor judgment.

Common Errors

- Unduly inflating the benefit of a decision
- Lack of knowledge of the hazards associated with a decision
- Underestimating the risks involved with a decision
- Lack of knowledge, or underestimating, the consequences resulting from a decision
- Getting into a situation where the consequences of previous bad decisions (dehydration, fatigue, stress, hypoxia) hinder your ability to make good decisions
- Failure to use a systematic decision making process
- Failure to plan ahead, and as a result having to make unnecessarily rushed decisions

Completion Standard

This lesson is complete when you are able to use a systematic decision making process to reach appropriate decisions based on your personal values.

9.3 Self-Discipline

Purpose

Good judgment is wasted if you don't act on it. In this lesson, your instructor will evaluate your ability to follow through on the decisions that you arrived at in the last lesson.

Procedure

In the previous lesson, you identified some personal limits regarding minimum thermaling heights, glide slope management, weather conditions, etc. As your training progresses and you become increasingly skilled, your instructor will allow you to encounter situations in which you approach these, and perhaps other, personal limits. It will be up to you to maintain the self-discipline necessary to respect and uphold your limits and follow through on your predetermined course of action.

Common Errors

- Failure to respect your personal limits because of peer pressure, fixation on a goal, rationalization, complacency, impulsivity, or deference to others
- Disregarding rules, regulations, or operating limits

Completion Standard

This lesson is complete when you have the self-discipline to consistently respect your personal limits.

CHAPTER 1: ORIENTATION, PRE-FLIGHT, POST-FLIGHT

1.1 Primary Flight Controls

1.1.1 In normal, level flight, moving the stick forward will have what effect on the glider's speed and attitude?

1.1.2 In normal, level flight, moving the stick to the right will have what effect on the glider's attitude?

1.1.3 In normal, level flight, pushing on the right rudder pedal will have what effect on the glider's attitude?

1.2 Secondary Flight Controls

1.2.1 Where is the towrope release knob located?

1.2.2 How do you actuate the wheel brake?

1.2.3 If you have to apply constant back pressure on the stick to maintain your desired airspeed, you need to make an adjustment to which control?

1.3 Using the Flight Instruments

1.3.1 Where can you find the V_{NE} (never-exceed speed) of the glider?

1.3.2 At higher elevations, how will the true airspeed compare to the indicated airspeed?

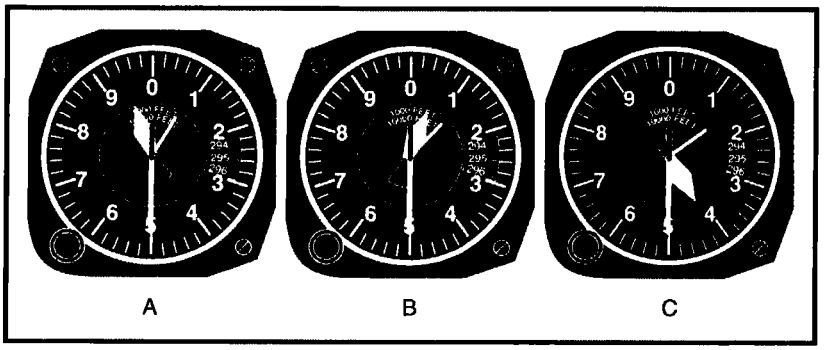


Figure 1.1

1.3.3 In Figure 1.1, altimeter A is indicating what altitude?

1.3.4 In Figure 1.1, altimeter B is indicating what altitude?

1.3.5 In Figure 1.1, altimeter C is indicating what altitude?

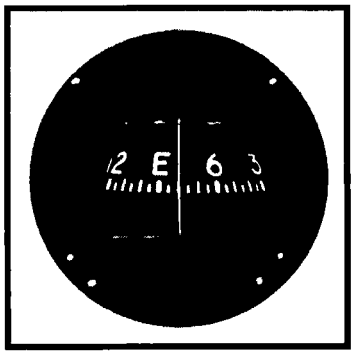


Figure 1.2

1.3.6 If the compass in the glider is as shown in Figure 1.2, to fly a magnetic heading of 50°, you should turn the glider about

A [ ] 30° to the left.

B [ ] 30° to the right.

C [ ] 50° to the right.

1.3.7 A glider normally sinks at 2 knots when flying at an airspeed of 45 knots in still air. If the glider is flying straight at a constant 45 knot airspeed, and the total energy compensated vario is indicating +3 knots, how fast is the air mass rising?

A [ ] 1 knots

B [ ] 3 knots

C [ ] 5 knots.

1.4 Ground Handling

1.4.1 When moving a glider on the ground, you should turn it by

A [ ] pushing forward on one wingtip while holding back on the other.

B [ ] making sure that only the main wheel is touching the ground before rotating the glider.

C [ ] pulling sideways on the nose or tail.

1.4.2 The glider is easiest to move on the ground if you

A [ ] keep the nose pointed into the wind as much as possible.

B [ ] keep the tail pointed into the wind as much as possible.

C [ ] have one person push on each wing tip.

1.4.3 When moving a glider with the canopy open, extra care should be taken when

A [ ] near areas where the prop blast from a power aircraft could blow the canopy closed.

B [ ] rotating the glider with respect to the wind direction.

C [ ] both A and B.

1.5 Preflight Inspection

1.5.1 When should you perform a preflight inspection of the glider?

A [ ] Before every takeoff

B [ ] Each morning

C [ ] Before each flying session

1.5.2 If during the preflight inspection, you find an issue with the glider, you should

A [ ] bring it up next time you see your instructor or the mechanic.

B [ ] address the issue immediately.

C [ ] ask your instructor about the issue before the flight.

1.6 Positive Control Check

1.6.1 What is the minimum number of people required to perform a positive control check?

A [ ] 1

B [ ] 2

C [ ] 3.

1.6.2 A positive control check consists of

A [ ] moving the controls and verifying that the control surfaces move in the appropriate direction.

B [ ] moving the controls through the full range of movement as a helper provides resistance at the control surfaces.

C [ ] visually confirming the controls are correctly hooked up.

1.7 Towrope Inspection

1.7.1 Where is the most likely place the towrope will suffer damage?

1.7.2 A tow ring is OK to use as long as it is not

A [ ] bent.

B [ ] cracked.

C [ ] bent, cracked, or deformed.

1.8 Securing the Glider

1.8.1 Why should you not tie back the stick in the back seat of a two-place glider?

1.9 Area Familiarization

1.9.1 Name three local landmarks and their relative position from your home gliderport.

CHAPTER 2: TAKEOFFS

2.1 Takeoff Checklist

2.1.1 What can happen if you don't use a written checklist before each takeoff?

2.1.2 What should you do if you have to break your normal routine while performing your takeoff checklist?

2.2 Takeoff Procedures and Signals

2.2.1 What signal does the line-person give to tell you to open the tow hook so that they can hook up the towrope?

2.2.2 What is the "take up slack" signal?

2.2.3 What is the tow pilot looking for before beginning the take off?

A [ ] Rudder waggle from the glider pilot

B [ ] Arm swinging in a circle from the line-person

C [ ] Both A and B

2.2.4 During the initial takeoff, the wing runner should

A [ ] keep the wings level as long as possible.

B [ ] allow the wings to tilt, but keep the tips from touching the ground.

C [ ] push or pull on the wingtip to keep the glider rolling straight.

2.3 Takeoff

2.3.1 During the takeoff roll, you control the path of the glider with the

A [ ] ailerons.

B [ ] rudder.

C [ ] ailerons and rudder.

2.3.2 How should the stick be held at the beginning of the takeoff, and why?

2.3.3 As the glider obtains flying speed, you should

A [ ] allow the glider to lift off without changing the pitch attitude.

B [ ] raise the nose to cause the glider to lift off.

C [ ] lower the nose to keep the glider on the ground until the tow plane lifts off.

2.4 Crosswind Takeoff

2.4.1 In preparation for a crosswind takeoff, the glider should be positioned on the runway with the?

A [ ] nose slightly into the wind, on the upwind side of the runway.

B [ ] nose slightly away from the wind, on the downwind side of the runway.

C [ ] nose slightly away from the wind, on the upwind side of the runway.

2.4.2 During the very beginning of a crosswind takeoff, you should

A [ ] apply full upwind rudder.

B [ ] apply full downwind rudder.

C [ ] hold the rudder neutral.

2.4.3 During a crosswind takeoff, you should hold the

A [ ] upwind wing lower.

B [ ] upwind wing higher.

C [ ] wings level.

2.4.4 If you have a crosswind from the right, and you cannot keep the glider from weathervaning during the takeoff roll, you should

A [ ] lower the right wing.

B [ ] apply more left rudder.

C [ ] release the towrope and apply the brakes.

2.5 Takeoff Without a Wing Runner

2.5.1 When performing a takeoff without a wing runner, the wingtip on the ground will have more drag because of

A [ ] friction with the ground.

B [ ] induced drag from the aileron deflection required to lift it.

C [ ] both A and B.

2.5.2 During the initial takeoff roll without a wing runner in calm winds, you should

A [ ] hold rudder towards the low wing.

B [ ] hold rudder towards the high wing.

C [ ] keep the rudder neutral.

2.5.3 What must you do if you can't keep the glider from veering in the direction of the lowered wing?

2.6 Downwind Takeoff

2.6.1 Compared to a takeoff into the wind, a downwind takeoff will require

A [ ] more runway.

B [ ] less runway.

C [ ] about the same amount of runway.

2.6.2 Compared to a takeoff into the wind, when taking off downwind the glider will lift off

A [ ] at a lower ground speed.

B [ ] at the same ground speed.

C [ ] at the same airspeed.

2.6.3 What must you do if you can't keep the glider from veering toward the side of the runway when performing a downwind takeoff?

2.7 High Density Altitude Takeoff

2.7.1 A high density altitude takeoff is most similar to a

A [ ] normal takeoff.

B [ ] crosswind takeoff.

C [ ] downwind takeoff.

2.7.2 Compared to a downwind takeoff, the acceleration during a high density altitude takeoff will be

A [ ] faster.

B [ ] slower.

C [ ] the same.

2.7.3 What must you do if you can't keep the glider from veering toward the side of the runway when performing a high density altitude takeoff?

CHAPTER 3: AEROTOW

3.1 Introduction to Flying the Aerotow

3.1.1 The most likely cause of the glider drifting out of position when on tow is

A [ ] not matching the tow plane's bank angle.

B [ ] a horizontal wind gust.

C [ ] the tow pilot's failure to fly straight.

3.1.2 What should you look for to determine if you are at the same altitude as the tow plane?

3.1.3 What should you look for to determine if you are directly behind the tow plane?

3.2 Flying the Aerotow with Stick and Rudder

3.2.1 What should you use as a visual reference when trying to keep the glider in coordinated flight while on tow?

A [ ] The yaw string

B [ ] The horizon

C [ ] The tow plane

3.3 Release from Tow

3.3.1 You should not release from tow when you are lower than the tow plane because

A [ ] the towrope could become slack, creating a knot in the rope.

B [ ] the towrope could become entangled with the glider.

C [ ] the upward pull of the rope on the nose of the glider can cause it to stall.

3.3.2 When releasing from tow, you should turn to the right

A [ ] after you pull the release.

B [ ] after you verify the rope has released.

C [ ] as you pull the release.

3.3.3 After releasing from tow, you should adjust the glider for the proper cruise speed

A [ ] after finishing your turn to the right.

B [ ] immediately after releasing from tow.

C [ ] after locating the airport.

3.4 "Soft" Release

3.4.1 What causes slack to form in the towrope when performing a "soft" release?

3.4.2 The most critical part of performing a "soft" release is to

A [ ] descend fast enough to cause slack to form in the towrope.

B [ ] wait for the slack to develop before pulling the release.

C [ ] never descend below the tow plane.

3.5 Shifting Through the Wake

3.5.1 When descending though the wake, your movement should be

A [ ] slow and steady.

B [ ] quick and abrupt.

C [ ] fast but smooth.

3.5.2 Slack can develop in the rope if you

A [ ] linger in the wake.

B [ ] climb too quickly from low tow position.

C [ ] descend too quickly into low tow position.

3.6 Steering Turns

3.6.1 To indicate to the tow pilot that you want to turn to the right, you should position the glider

A [ ] above and to the left of the tow plane.

B [ ] level with and to the right of the tow plane.

C [ ] level with and to the left of the tow plane.

3.6.2 While in a steering turn to the right, you would indicate to the tow pilot that you would like to stop turning by positioning the glider

A [ ] to the left of the tow plane.

B [ ] to the right of the tow plane.

C [ ] behind the tow plane.

3.6.3 When in a steering turn, will the glider try to climb or dive? Why?

3.7 Aerotow Signals

3.7.1 Which aerotow signal results in an increase in drag?

A [ ] Speed up

B [ ] Slow down

C [ ] Glider release failure

3.7.2 When you move to the left of the tow plane and rock your wings

A [ ] the tow plane should release the towrope.

B [ ] the tow plane should speed up.

C [ ] the tow plane should rock its wings.

3.7.3 When the tow plane rocks its wings, you

A [ ] should release the towrope when you have reached a safe altitude.

B [ ] should verify that your airbrakes are closed.

C [ ] MUST release immediately.

3.8 Boxing the Wake

3.8.1 When in the upper corners of the "box" the glider should be

A [ ] below the tow plane.

B [ ] level with the tow plane.

C [ ] above the tow plane.

3.8.2 What control inputs will be necessary to hold the glider in the lower left corner of the "box"?

A [ ] Forward-left stick, right rudder

B [ ] Back-right stick, left rudder

C [ ] Forward-left stick, left rudder

3.9 Slack Rope on Tow

3.9.1 If the glider is in position behind the tow plane and there is slack in the rope, the minimum action required to remove the slack is for the glider pilot to

A [ ] climb with respect to the tow plane.

B [ ] do nothing.

C [ ] enter a gentle slip to increase the drag.

3.9.2 Why is it important to stay to the side of the tow plane when there is slack in the towrope?

3.9.3 Why is it important to stay above the tow plane when there is slack in the towrope?

3.9.4 What effect will descending have when there is slack in the rope?

3.9.5 What should you do if you lose sight of the tow plane?

3.10 Slack Rope in a Turn

3.10.1 What can you do to increase the drag on the glider to remove slack from the towrope that occurs during a turn?

3.10.2 When slack has developed in the towrope during a turn, moving to the inside of the turn will

A [ ] increase the slack.

B [ ] decrease the slack.

C [ ] have no effect on the slack.

CHAPTER 4: IN-FLIGHT MANEUVERS

4.1 Transferring Control of the Glider

4.1.1 When your instructor says "You take the controls" you should respond by

A [ ] taking the controls.

B [ ] taking the controls and saying "I have the controls".

C [ ] saying "I have the controls".

4.1.2 When your instructor says "I have the controls" you should respond by

A [ ] releasing the controls.

B [ ] releasing the controls and saying "You have the controls".

C [ ] saying "You have the controls".

4.2 Scanning for Traffic

4.2.1 The most important place to look for traffic is

A [ ] above the horizon.

B [ ] at or near the horizon.

C [ ] below the horizon.

4.2.2 Is it necessary to look both directions before initiating a turn? Why?

4.2.3 Prior to starting each maneuver, pilots should

A [ ] check altitude, airspeed, and heading indications.

B [ ] visually scan the entire area for collision avoidance.

C [ ] announce their intentions on the nearest CTAF.

4.2.4 Describe how to scan for traffic while in circling flight.

4.3 Pitch/Speed Control

4.3.1 To control the airspeed of the glider, you must monitor the

A [ ] pitch attitude.

B [ ] airspeed indicator.

C [ ] angle of attack.

4.3.2 To keep the airspeed of the glider constant, you should

A [ ] quickly correct any deviations shown on the airspeed indicator.

B [ ] keep the control stick in a constant position.

C [ ] quickly correct any deviations from the desired pitch attitude.

4.3.3 If you wish to increase the airspeed of the glider, you must

A [ ] lower the nose of the glider momentarily.

B [ ] maintain a lower pitch attitude.

C [ ] maintain a higher pitch attitude.

4.4 Using the Trim Control

4.4.1 When the glider is properly trimmed

A [ ] it will always fly at the desired airspeed.

B [ ] no stick force will be required to maintain the desired pitch angle.

C [ ] it will always try to fly at the best glide speed.

4.4.2 When adjusting the trim, you should

A [ ] keep your eye on the airspeed indicator.

B [ ] keep your eye on the pitch attitude.

C [ ] not allow the stick to move.

4.4.3 If you have trimmed the glider for the desired airspeed, and you find yourself applying back pressure to the stick, you will be flying

A [ ] slower than desired.

B [ ] at the desired airspeed.

C [ ] faster than desired.

4.5 Shallow/Medium Bank Turns

4.5.1 How do you initiate a turn?

4.5.2 How do you maintain a turn?

4.5.3 Is adverse yaw present during the turn?

4.5.4 How do you stop a turn?

4.5.5 When rolling to the left while holding the rudder neutral, which way will the glider yaw?

4.5.6 How can you determine if you are using the correct amount of rudder when rolling into or out of a turn?

4.6 Precision Turns

4.6.1 When turning to a specified magnetic compass heading, you should

A [ ] recover from the turn just before the magnetic compass indicates the desired heading.

B [ ] use very small bank angles, and recover when the compass indicates the desired heading.

C [ ] while in level flight, choose a landmark on the horizon that is approximately at the desired heading and then turn to it.

4.7 Airbrakes in Flight

4.7.1 What will happen to the airspeed if you maintain a constant pitch attitude when deploying the airbrakes?

4.7.2 If you maintain a constant airspeed while deploying the airbrakes, your

A [ ] sink rate will increase, and your glide slope will become steeper.

B [ ] sink rate will decrease, and your glide slope will become steeper.

C [ ] sink rate will increase, and your glide slope will remain constant.

4.8 Steep Turns

4.8.1 How much will the load factor increase if the bank angle increases from 45° to 55°?

4.8.2 How much will the load factor increase if the bank angle increases from 60° to 70°?

4.8.3 During a steep turn, the glider will stall at a

A [ ] higher airspeed.

B [ ] higher angle of attack.

C [ ] lower angle of attack.

4.8.4 How can you determine when the glider is banked 45°?

4.8.5 If your glider stalls at 40 knots in straight and level flight, and you are flying at 50 knots, can you perform a 60° bank turn without increasing your airspeed?

4.9 Circling Flight

4.9.1 A slip that occurs during circling flight when the rudder is held neutral is probably the result of

A [ ] holding the nose of the glider too high.

B [ ] holding the nose of the glider too low.

C [ ] adverse yaw.

4.9.2 Which of the following will decrease the radius of turn:

A [ ] increasing airspeed, or increasing bank angle.

B [ ] decreasing airspeed, or decreasing bank angle.

C [ ] decreasing airspeed, or increasing bank angle.

4.9.3 To maintain a constant airspeed and bank angle during circling flight, you should monitor the

A [ ] horizon.

B [ ] airspeed indicator and the yaw string.

C [ ] airspeed indicator.

4.10 Crabbing During Cruising Flight

4.10.1 During crabbing flight, the glider will not travel as far over the ground because

A [ ] a component of the airspeed is perpendicular to the desired direction of travel.

B [ ] crabbing flight is less efficient.

C [ ] of the increased drag resulting from the required control deflections.

4.10.2 During crabbing flight, the yaw string will be deflected

A [ ] slightly away from the wind.

B [ ] straight back.

C [ ] slightly towards the wind.

4.11 Stall Recognition and Recovery in Level Flight

4.11.1 Stalls are particularly dangerous when

A [ ] flying at airspeeds greater than the maneuvering speed.

B [ ] flying at low speeds.

C [ ] flying close to the ground.

4.11.2 What causes a glider to stall?

A [ ] exceeding the critical angle of attack.

B [ ] flying slower than the stall speed of the glider.

C [ ] having the glider at too high of a pitch attitude.

4.11.3 List the warning signs of a stall, in the order that they occur.

4.11.4 What must you do to recover from a stall?

4.12 Stall Recognition and Recovery in a Turn

4.12.1 During a turn the inside wing is at

A [ ] a smaller angle of attack than the outside wing.

B [ ] the same angle of attack as the outside wing.

C [ ] a greater angle of attack than the outside wing.

4.12.2 List the warning signs of a stall, in the order that they occur.

4.12.3 Why is the glider likely to spin if you try to raise the inside wing with the ailerons while the glider is stalled?

4.13 Slow Flight

4.13.1 How should you respond if you feel buffeting while flying at MCA?

4.13.2 Why is more rudder needed to coordinate the glider at MCA?

4.13.3 What will happened if you increase your bank angle when flying at MCA without increasing your airspeed?

4.14 Stall Recognition and Recovery with Airbrakes

4.14.1 List the warning signs of a stall, in the order that they occur.

4.14.2 Which stall warning sign may be masked by having the airbrakes open?

4.14.3 The first action you should take to recover from a stall when the airbrakes are open is to

A [ ] lower the nose of the glider.

B [ ] close the airbrakes.

C [ ] keep the wings level using the ailerons.

4.15 Side Slip – Correcting for Alignment Errors

4.15.1 How do you initiate a side slip to adjust for alignment errors?

4.15.2 How should your heading change when entering a side slip to adjust your alignment with the runway?

4.15.3 How do you recover from a side slip once you are aligned properly with the runway?

4.16 Side Slip – Compensating for a Crosswind

4.16.1 Which control(s) would you use when initially transitioning between a crab and a side slip to compensate for a crosswind?

4.16.2 How should your heading change when transitioning from a crab to a side slip on final?

4.16.3 How will your descent angle change when using a side slip in a crosswind on final? Why?

4.17 Forward Slip

4.17.1 A forward slip is used to

A [ ] compensate for a crosswind.

B [ ] adjust for alignment errors on final.

C [ ] increase your decent rate.

4.17.2 How will the track and heading change during a properly performed forward slip?

A [ ] The track will remain constant, but the heading will change.

B [ ] The track and heading will both remain constant.

C [ ] The track will change, but the heading will remain constant.

4.18 Low-G Maneuvers

4.18.1 The angle of attack during zero-G flight is

A [ ] the critical angle of attack.

B [ ] greater than the critical angle of attack.

C [ ] 0°.

4.19 Selecting a Cruise Airspeed

4.19.1 Your desired cruise speed will depend on

A [ ] your objectives.

B [ ] the conditions.

C [ ] both A and B.

4.19.2 The speed to maximize flight time in calm air will be

A [ ] greater than the speed to maximize glide distance.

B [ ] the same as the speed to maximize glide distance.

C [ ] less than the speed to maximize glide distance.

4.19.3 To maximize your glide slope when flying into a headwind you should fly

A [ ] at the best L/D speed of the glider.

B [ ] at the best L/D speed of the glider plus 1/2 the wind speed.

C [ ] at the best L/D speed of the glider plus the wind speed.

4.20 Deep Stall Recognition and Recovery

4.20.1 If the glider is in a deep stall

A [ ] it will be descending at a very steep angle.

B [ ] lowering the nose to the horizon will cause the glider to recover.

C [ ] the elevator will be effective at maintaining pitch control.

4.20.2 After initiating recovery from a deep stall, what can happen if you bring the nose to a normal pitch attitude before reaching normal flying speed?

4.21 Chandelle

4.21.1 The bank angle at the end of a "chandelle" should be

A [ ] 30°.

B [ ] 45°.

C [ ] 60°.

4.21.2 For a glider that has a straight and level minimum sink speed of 45 knots, the airspeed at the end of a "chandelle" should be

A [ ] 45 knots.

B [ ] 54 knots.

C [ ] 64 knots.

4.22 Incipient Spin Recognition and Recovery

4.22.1 Why can skidding during a turn lead to a spin?

4.22.2 List the warning signs of a stall, in the order that they occur.

4.22.3 What is the best way to avoid a spin related accident?

4.22.4 Why should the ailerons be held neutral when recovering from a spin?

4.23 Spin Recognition and Recovery

4.23.1 During a fully developed spin, the G-forces on the glider are

A [ ] less than 1-G.

B [ ] about 1-G.

C [ ] greater than 1-G.

4.23.2 If a spin transitions into a spiral dive, the G-forces will

A [ ] decrease.

B [ ] stay the same.

C [ ] increase.

4.23.3 What is the spin recovery procedure for the glider you are training in?

4.24 Rapid Speed Changes

4.24.1 To rapidly achieve a change in airspeed, you should

A [ ] quickly adjust the pitch attitude to that required for the desired airspeed.

B [ ] initially overshoot the desired pitch attitude.

C [ ] deploy the spoilers to slow down.

4.25 High-Speed Flight

4.25.1 At high speeds, adverse yaw is

A [ ] less pronounced.

B [ ] unchanged.

C [ ] more pronounced.

4.25.2 When exceeding the maneuvering speed, what is the maximum amount the controls should be deflected?

A [ ] 1/3

B [ ] 1/2

C [ ] 3/4

CHAPTER 5: LANDING PATTERNS

5.1 Landing Checklist

5.1.1 What are the items on the landing checklist?

5.1.2 What speed should you fly in the pattern?

5.1.3 If the glider you are training in does not have a retractable wheel, what should you do during the "undercarriage" part of the checklist?

5.1.4 What are the three things you should look for during the "look" part of the checklist?

5.2 Introduction to the Landing Pattern

5.2.1 What is the advantage of flying a standardized landing pattern?

5.2.2 How many turns will you make in the pattern if you perform an upwind entry?

5.2.3 Why is a crosswind pattern entry preferable to a base entry?

5.2.4 You should turn from crosswind to downwind

A [ ] between 800 and 1200 feet AGL.

B [ ] when you are 1600 to 2400 feet past the runway centerline.

C [ ] when the runway centerline is 30° below the horizon.

5.2.5 When should you select your stop, touchdown, and aim points?

5.2.6 You should turn from downwind to base

A [ ] between 500 and 800 feet AGL.

B [ ] when your aim point is 45° behind you.

C [ ] when your aim point is about 1000 feet behind you.

5.2.7 What is the benefit to flying "angles" in the pattern?

5.3 Glide Slope Control Using the Airbrakes

5.3.1 You should start to use your airbrakes in the pattern to control your glide slope when you

A [ ] are on downwind.

B [ ] turn from downwind to base.

C [ ] are on final.

5.3.2 Your goal on final is to have the airbrakes

A [ ] closed.

B [ ] open half-way.

C [ ] fully open.

5.3.3 Why should you not make sudden adjustments to the airbrake when close to the ground?

5.3.4 Why is it bad to touch down with the airbrakes fully deployed?

5.3.5 As you descend through a wind gradient, you will probably need to

A [ ] raise the nose and open the spoilers.

B [ ] use the stick to maintain a constant pitch attitude.

C [ ] lower the nose and close the spoilers.

5.4 Radio Use

5.4.1 What do you say on the radio when you first enter the pattern at your home airport?

5.5 Crosswind Patterns

5.5.1 When there is a crosswind, why is it better to fly the pattern so that the base leg is into, rather than with, the wind?

5.5.2 When flying with a tailwind close to the ground, most people will fly

A [ ] slower than intended.

B [ ] the intended airspeed.

C [ ] faster than intended.

5.5.3 With a direct crosswind, you will have to fly a crab on

A [ ] the downwind and final legs of the pattern.

B [ ] the crosswind and base legs of the pattern.

C [ ] all legs of the pattern.

5.6 Unusual Patterns

5.6.1 If you think you may be too low to perform a normal pattern, you should

A [ ] fly toward the normal IP.

B [ ] hope your instructor doesn't notice.

C [ ] try to intercept a pattern at a place appropriate to the altitude you have.

5.6.2 What airspeed should you fly when performing an "unusual" pattern?

5.7 Forward Slip with Airbrakes

5.7.1 A forward slip should be used along with airbrakes when

A [ ] there is no wind.

B [ ] you are too high to intersect the half-airbrake glide slope before arriving at the aim point.

C [ ] there is a crosswind.

5.7.2 You should remove the forward slip

A [ ] before you touch down.

B [ ] when you intersect the half-airbrake glide slope.

C [ ] A or B, whichever comes first.

5.8 Turning Slips

5.8.1 During a turning slip, the nose of the glider will be pointed

A [ ] to the outside of the turn.

B [ ] in the direction of flight.

C [ ] to the inside of the turn.

5.9 Side Slip in the Pattern

5.9.1 During a side slip on final, the nose of the glider should be pointed

A [ ] in the direction of flight.

B [ ] at the end of the runway.

C [ ] parallel to the runway.

5.9.2 When you are lined up with the runway centerline, you will terminate a side slip on final by

A [ ] banking momentarily in the direction opposite the slip.

B [ ] leveling the wings.

C [ ] momentarily applying rudder in the direction of the slip.

5.10 No Altimeter Pattern

5.10.1 When flying a pattern when the altimeter is inoperative or inaccurate, you should

A [ ] estimate the correct altitudes to turn downwind and base.

B [ ] fly a normal pattern, using angles to determine when to turn from crosswind to base, and base to final.

C [ ] fly a higher, closer pattern than normal.

5.11 No Altimeter/Airspeed Pattern

5.11.1 What could cause both your altimeter and airspeed indicator to malfunction?

5.11.2 When flying a pattern without reference to the altimeter or airspeed indicator you should

A [ ] fly the pattern with respect to angles, and the airspeed based on pitch attitude.

B [ ] make sure the glider touches down at your designated touchdown point.

C [ ] fly the pattern faster and closer in than normal.

5.12 No Airbrake Pattern

5.12.1 If your airbrakes fail in the pattern, instead of trying to fly a half-airbrake glide slope you should try to intercept the

A [ ] best L/D glide slope.

B [ ] minimum sink glide slope.

C [ ] the "half-rudder deflection" glide slope.

5.13 Full Airbrake Pattern

5.13.1 With the airbrakes fully open, the glider will perform similar to a glider

A [ ] at high altitude.

B [ ] with a missing canopy.

C [ ] that is more heavily loaded.

5.13.2 When flying a pattern when the airbrakes are stuck open, you should

A [ ] fly a normal pattern, using angles to determine when to turn from crosswind to base, and base to final.

B [ ] estimate the correct altitudes to turn downwind and base.

C [ ] fly a higher, closer pattern than normal.

CHAPTER 6: LANDINGS

6.1 Introduction to the Landing

6.1.1 What are the key elements of the final approach?

6.1.2 What are the key elements of the flare?

6.1.3 What are the key elements of the hold off?

6.1.4 What are the key elements of the rollout?

6.1.5 When in ground effect, the glider will

A [ ] experience an increase in performance.

B [ ] experience an increase in drag.

C [ ] stall at a higher airspeed.

6.1.6 The best way to prevent a pilot induced oscillation (PIO) is to

A [ ] move the stick firmly forward as soon as the glider touches down.

B [ ] touch down with minimum energy.

C [ ] touch down on the nose wheel first.

6.2 Precision Landings

6.2.1 The way to execute a precise landing is to

A [ ] use the stick to put the main wheel on the ground as soon as you are over the desired touchdown point.

B [ ] fly a precise pattern (using angles) in relation to your stop, touchdown, and aim points.

C [ ] rapidly open the spoilers all the way as soon as you are over the desired touchdown point.

6.2.2 Forcing the glider to touchdown at a high airspeed

A [ ] is the preferred method of performing a precision landing.

B [ ] should be followed by closing the airbrakes.

C [ ] is likely to lead to a PIO.

6.3 Crosswind Landings

6.3.1 The amount of rudder required to hold a slip on final varies because

A [ ] of the wind gradient.

B [ ] the speed of the glider is decreasing.

C [ ] of the crosswind.

6.3.2 The use of a slip will

A [ ] decrease the sink rate.

B [ ] not affect the sink rate.

C [ ] increase the sink rate.

6.3.3 Which control is used to adjust your track when in a slip?

A [ ] Elevator

B [ ] Rudder

C [ ] Aileron

6.3.4 Which control is used to keep the fuselage parallel with the runway centerline when in a slip?

A [ ] Elevator

B [ ] Rudder

C [ ] Aileron

6.4 Landing Over an Obstacle

6.4.1 When landing over an obstacle, your "aim" point should be

A [ ] just over the top of the obstacle.

B [ ] at a point from the obstacle that is a distance of 10 times the height of the obstacle.

C [ ] about 500 feet in front of your touchdown point.

6.4.2 Once you clear the obstacle, you should

A [ ] start your flare.

B [ ] open the spoilers all the way while pitching down to maintain airspeed.

C [ ] start to slow the glider down.

6.5 Simulated Off-Field Landing

6.5.1 When preparing to perform an off-field landing, you should

A [ ] fly lower and slower in the pattern to look for hazards on the ground.

B [ ] fly fast to avoid a stall or spin, and fly a tight pattern to keep from getting too far away from the touchdown point.

C [ ] fly a normal pattern at a normal airspeed.

6.5.2 When you land off of an airfield, you should

A [ ] get the glider stopped as soon as possible to avoid hitting unseen hazards.

B [ ] try to extend the rollout so that you can stop the glider near a gate, if available.

C [ ] touch down with plenty of speed to help maintain control authority.

6.6 Downwind Landings

6.6.1 A half-airbrake final approach to a downwind landing will appear

A [ ] higher than a normal approach.

B [ ] the same as a normal approach.

C [ ] lower than a normal approach.

6.6.2 Your pitch attitude at touchdown during a downwind landing will be

A [ ] higher than on a normal landing.

B [ ] the same as during a normal landing.

C [ ] lower than on a normal landing.

6.6.3 Your ground speed at touchdown during a downwind landing will be

A [ ] higher than on a normal landing.

B [ ] the same as during a normal landing.

C [ ] lower than on a normal landing.

6.7 High Wind Landings

6.7.1 During a high wind pattern and landing, you are more likely to fly at too low of an airspeed on

A [ ] the downwind leg.

B [ ] the base and crosswind legs.

C [ ] final.

6.7.2 Why is a pilot induced oscillation (PIO) more likely in a high wind landing?

6.7.3 During high winds, the wind gradient will be

A [ ] stronger.

B [ ] more dramatic behind obstacles.

C [ ] both A and B.

6.8 High Density Altitude Landings

6.8.1 When landing at a high altitude airport, your indicated airspeed should be

A [ ] less than at sea level.

B [ ] the same as at sea level.

C [ ] greater than at sea level.

6.8.2 Your pitch attitude at touchdown during a high altitude landing will be

A [ ] higher than on a normal landing.

B [ ] the same as during a normal landing.

C [ ] lower than on a normal landing.

6.8.3 Why would a downwind landing at a high altitude be more dangerous?

CHAPTER 7: FLYING IN LIFT

7.1 Thermaling

7.1.1 What is the best visual indication of a thermal?

A [ ] Fragmented cumulus clouds with concave bases

B [ ] Cumulus clouds with concave bases

C [ ] Scattered to broken sky with cumulus clouds

7.1.2 Which would probably be the best thermal generator?

A [ ] A tree covered hill

B [ ] A parking lot

C [ ] An irrigated field

7.1.3 When entering an occupied thermal, you should circle in the same direction as the glider(s) already in the thermal

A [ ] unless you are well above the other gliders.

B [ ] unless you are well below the other gliders.

C [ ] regardless of your altitude when you enter.

7.1.4 If you increase your bank angle from 20° to 40°, the sink rate of the glider through the airmass will

A [ ] remain about the same.

B [ ] increase by about 30%.

C [ ] increase by about 100%.

7.1.5 If you increase your bank angle from 40° to 60°, the sink rate of the glider through the airmass will

A [ ] remain about the same.

B [ ] increase by about 30%.

C [ ] increase by about 100%.

7.2 Mountain Wave

7.2.1 The maximum speed you should fly when near a rotor is

A [ ] the best L/D speed.

B [ ] minimum sink speed.

C [ ] maneuvering speed.

7.2.2 If you find yourself being blown downwind in wave, you should

A [ ] descend.

B [ ] speed up, even if it means exceeding the redline speed.

C [ ] climb higher to try to find lower wind speeds.

7.2.3 Wave lift will be located downwind of a mountain ridge and

A [ ] perpendicular to the wind direction.

B [ ] parallel to the ridge.

C [ ] above the rotor.

7.3 Ridge Lift

7.3.1 The strongest ridge lift is typically

A [ ] in front of the peak of the ridge.

B [ ] directly over the peak of the ridge.

C [ ] behind the peak of the ridge.

7.3.2 You should always approach a ridge

A [ ] from behind.

B [ ] from the upwind side at an angle no greater than 45° to the ridge.

C [ ] directly with the wind.

7.3.3 When flying in ridge lift, the nose of the glider will be

A [ ] pointing parallel to the ridge.

B [ ] angled into the wind.

C [ ] angled away from the wind.

7.3.4 If you are overtaking a glider on the ridge, you should pass on the

A [ ] left.

B [ ] inside.

C [ ] outside.

7.3.5 If you are approaching a glider head-on while ridge flying, you should pass to the

A [ ] right.

B [ ] inside.

C [ ] outside.

7.4 Convergence/Shear

7.4.1 Convergence lift is created when

A [ ] warm moist air collides with cool, dry air.

B [ ] two airmasses collide.

C [ ] stable air converges with a mountain range.

7.4.2 Convergence lift tends to

A [ ] be wide spread and strong.

B [ ] be localized along a narrow band.

C [ ] increase with altitude.

CHAPTER 8: EMERGENCY PROCEDURES

8.1 Introduction to Premature Aerotow Release

8.1.1 Typically, if the rope breaks when you are below 200 feet AGL, you should

A [ ] land straight ahead.

B [ ] perform a 180° turn and land back on the runway.

C [ ] perform an abbreviated pattern.

8.1.2 Typically, if the rope breaks when you are between 200 feet and 400 feet AGL, you should

A [ ] land straight ahead.

B [ ] perform a 180° turn and land back on the runway.

C [ ] perform an abbreviated pattern.

8.1.3 Typically, if the rope breaks when you are above 400 feet AGL, you should

A [ ] land straight ahead.

B [ ] perform a 180° turn and land back on the runway.

C [ ] perform an abbreviated pattern.

8.1.4 Why is it important to have a prearranged rope-break plan?

8.2 Simulated Rope Breaks

8.2.1 When the rope breaks, your most important task is to

A [ ] determine a plan of action.

B [ ] maintain control of the glider.

C [ ] make a radio call declaring an emergency.

8.2.2 **When executing your rope break plan, your goal is to**

A [ ] get the glider safely on the ground.

B [ ] get the glider to the normal "stop point" on the runway.

C [ ] use your normal aim, touchdown, and stop points.

8.3 Rock Off

8.3.1 **If the tow plane rocks its wings during the tow, you**

A [ ] should confirm that your spoilers are closed and locked.

B [ ] must release immediately.

C [ ] should determine a plan of action then pull the release.

8.4 Tow Plane Power Loss During Takeoff

8.4.1 **If the tow plane loses power during takeoff, your first indication will probably be**

A [ ] smoke.

B [ ] the sudden deceleration of the glider.

C [ ] slack in the towrope.

8.4.2 **What do the actions you take during a normal release, and the actions you should take when the tow plane loses power during the takeoff, have in common?**

8.5 Tow Plane Power Loss at Altitude

8.5.1 **If the tow plane loses power during the tow, your first indication will probably be**

A [ ] smoke.

B [ ] the sudden deceleration of the glider.

C [ ] slack in the towrope when you try to stay level with the tow plane.

8.5.2 If you determine that the tow plane has lost power during the tow, your first actions should be to

A [ ] determine a plan of action then pull the release.

B [ ] pull the release and turn right.

C [ ] initiate slack line recovery procedures.

8.6 Simultaneous Release Failure

8.6.1 When intentionally breaking the rope the glider should be positioned

A [ ] above and to the side of the tow plane.

B [ ] directly behind the tow plane.

C [ ] directly behind and below the tow plane.

8.6.2 When descending on tow, you should

A [ ] maintain a constant spoiler setting.

B [ ] used the spoilers to control the descent rate.

C [ ] keep the spoilers closed and locked.

8.6.3 After landing on tow, you should

A [ ] veer to the left side of the runway.

B [ ] stay on the centerline of the runway.

C [ ] veer to the right side of the runway.

8.7 Spiral Dive Recovery

8.7.1 How do the physical sensations experienced during a spiral dive differ from those during a spin?

8.7.2 A spiral dive can damage the glider by

A [ ] overloading the structure.

B [ ] exceeding the airspeed limits of the glider.

C [ ] both A and B.

8.7.3 **The first step in recovering from a spiral dive is to**

A [ ] raise the nose by increasing the back pressure on the stick.

B [ ] apply rudder in the opposite direction of the turn.

C [ ] relax the back pressure on the stick to reduce the G-loading.

8.8 Unusual Attitude Recovery

8.8.1 **What should you do to recover from an unusual attitude when the nose of the glider is above the horizon?**

8.8.2 **What should you do to recover from an unusual attitude when the nose of the glider is below the horizon?**

8.8.3 **If the glider unintentionally ends up inverted, you should**

A [ ] bail out.

B [ ] strive to keep the nose of the glider above the horizon (stick forward) as you use the ailerons to roll upright.

C [ ] perform half of a loop (stick back) to return to normal flight.

8.9 Intercept Procedures

8.9.1 **To indicate that you have been "intercepted", a military or law enforcement aircraft will**

A [ ] fly along side you and rock its wings.

B [ ] fire a warning shot in front of you.

C [ ] take a position directly in front of you.

8.9.2 **If you are equipped with a radio and a transponder, what should you do if you are intercepted?**

8.9.3 You should follow the intercepting aircraft until

A [ ] you are clear of the restricted airspace.

B [ ] it performs an abrupt 90° climbing turn.

C [ ] it changes heading using a shallow turn.

8.9.4 If the intercepting aircraft cycles (lowers then raises) its landing gear, it is an indication that

A [ ] you have been released.

B [ ] you should land at the airport below.

C [ ] your landing gear is not retracted.

CHAPTER 9: AERONAUTICAL DECISION MAKING

9.1 Situational Awareness

9.1.1 Things that you can do to promote situational awareness include

A [ ] maintaining flight proficiency by flying regularly.

B [ ] preparing a plan for your flight, thus limiting the number of in-flight decisions that you must make.

C [ ] both A and B.

9.2 Judgment

Consider an activity that you do on a regular basis that has risk involved.

ACTIVITY:

9.2.1 What is the benefit of this activity?

9.2.2 What are the hazards involved with this activity?

9.2.3 What is the risk that you might encounter the hazards?

9.2.4 What are the consequences of encountering the hazards?

9.2.5 What preventions can you take to reduce the chance of encountering the hazards?

9.2.6 What precautions can you take to minimize the consequences if you do encounter the hazards?

9.2.7 What are the values that you have that convince you to participate in this activity despite its risk?

9.3 Self-Discipline

9.3.1 In aviation, the best way to develop and maintain self-discipline is to

A [ ] learn from your own mistakes.

B [ ] determine the limitations of yourself and your glider by experimentation.

C [ ] follow the FAA regulations, club/FBO rules, and glider manufacturer's limits.

9.3.2 Complacency can be avoided by

A [ ] setting personal limits and following them every time.

B [ ] following the lead of other, more experience pilots.

C [ ] only taking risks that you have gotten away with in the past.

CHAPTER 1

1.1 Primary Flight Controls

1.1.1 *Moving the stick forward will pitch the nose of the glider down and increase the airspeed.*

1.1.2 *Moving the stick to the right will cause the glider to roll to the right. In addition, the glider will yaw to the left due to adverse yaw.*

1.1.3 *Pushing on the right rudder pedal will yaw the glider to the right.*

1.2 Secondary Flight Controls

1.2.1 *(glider specific)*

1.2.2 *(glider specific)*

1.2.3 *The trim*

1.3 Using the Flight Instruments

1.3.1 *Marked by the red line on the airspeed indicator, on a placard in the glider. (or in the flight manual.)*

1.3.2 *At higher elevations, true airspeed will be greater than indicated airspeed.*

1.3.3 *9,500 feet MSL*

1.3.4 *10,500 feet MSL*

1.3.5 *14,500 feet MSL*

1.3.6 *[A]*

1.3.7 *[C]*

1.4 Ground Handling

1.4.1 *[B]*

1.4.2 *[A]*

1.4.3 *[C]*

1.5 Preflight Inspection

1.5.1 *[C]*

1.5.2 *[B]*

1.6 Positive Control Check

1.6.1 *[B]*

1.6.2 *[B]*

1.7 Towrope Inspection

1.7.1 *At the knot where the rope is attached to the tow ring, or where any knots accidentally form in the towrope*

1.7.2 *[C]*

1.8 Securing the Glider

1.8.1 *You should not tie back the stick in the back seat of a two-place glider because if someone fails to release it before takeoff, it could cause an accident.*

1.9 Area Familiarization

1.9.1 *(Site specific)*

CHAPTER 2

2.1 Takeoff Checklist

2.1.1 *If you do not follow a checklist, you might forget to check an item that could compromise safety.*

2.1.2 *If you get interrupted while performing your checklist, you should make sure you do not skip forward, and if unsure, you should start it over from the beginning.*

2.2 Takeoff Procedures and Signals

2.2.1 *The line person will present an open palm to signal you to open the tow hook.*

2.2.2 *The line persons swings their arm in a low arc, back and forth, while holding one wing high.*

2.2.3 *[C]*

2.2.4 *[B]*

2.3 Takeoff

2.3.1 *[B]*

2.3.2 *During a normal (not crosswind) takeoff, the stick should be held aft of neutral so that the glider will rotate off of its nose wheel (or skid) as soon as possible. (If your training glider is a tail-dragger, the stick should be held forward of neutral to raise the tail of the glider off of the ground as soon as possible.)*

2.3.3 *[A]*

2.4 Crosswind Takeoff

2.4.1 *[C]*

2.4.2 *[B]*

2.4.3 *[A]*

2.4.4 *[C]*

2.5 Takeoff Without a Wing Runner

2.5.1 *[C]*

2.5.2 *[B]*

2.5.3 *Release.*

2.6 Downwind Takeoff

2.6.1 *[A]*

2.6.2 *[C]*

2.6.3 *Release.*

2.7 High Density Altitude Takeoff

2.7.1 *[C]*
2.7.2 *[B]*
2.7.3 *Release.*

CHAPTER 3

3.1 Introduction to Flying the Aerotow

3.1.1 *[A]*
3.1.2 *If you are at the same altitude as the tow plane, the horizon will intersect the tow plane.*
3.1.3 *If you are directly behind the tow plane its rudder will appear centered over the fuselage.*

3.2 Flying the Aerotow with Stick and Rudder

3.2.1 *[C]*

3.3 Release from Tow

3.3.1 *[B]*
3.3.2 *[B]*
3.3.3 *[A]*

3.4 "Soft" Release

3.4.1 *Acceleration of the glider with respect to the tow plane*
3.4.2 *[C]*

3.5 Shifting Through the Wake

3.5.1 *[A]*
3.5.2 *[C]*

3.6 Steering Turns

3.6.1 *[C]*
3.6.2 *[C]*
3.6.3 *When in a steering turn, the glider will try to climb because its airspeed is greater than that of the tow plane.*

3.7 Aerotow Signals

3.7.1 *[B]*
3.7.2 *[A]*
3.7.3 *[C]*

3.8 Boxing the Wake

3.8.1 *[B]*
3.8.2 *[C]*

3.9 Slack Rope on Tow

3.9.1 *[B]*

3.9.2 *It is important to stay to the side of the tow plane when there is slack in the towrope so that you can see and avoid the rope and to help absorb the shock when the rope comes tight.*

3.9.3 *It is important to stay above the tow plane when there is slack in the towrope so that the glider does not become tangled in the rope. Climbing also reduces the amount of slack in the rope.*

3.9.4 *Descending will tend to increase slack in the rope.*

3.9.5 *Release.*

3.10 Slack Rope in a Turn

3.10.1 *Enter a slip, or open the spoilers.*

3.10.2 *[A]*

CHAPTER 4

4.1 Transferring Control of the Glider

4.1.1 *[B]*

4.1.2 *[B]*

4.2 Scanning for Traffic

4.2.1 *[B]*

4.2.2 *By looking both directions before initiating a turn you will see any traffic that you might turn into, as well as traffic that might overtake you once you have completed the turn.*

4.2.3 *[B]*

4.2.4 *Look at a point on the horizon to the inside of the turn, about 45 to 90° from your heading, and keep looking at that point until the nose of the glider is aimed at that point. Then, glance at the instruments, and repeat.*

4.3 Pitch/Speed Control

4.3.1 *[A]*

4.3.2 *[C]*

4.3.3 *[B]*

4.4 Using the Trim Control

4.4.1 *[B]*

4.4.2 *[B]*

4.4.3 *[A]*

4.5 Shallow/Medium Bank Turns

4.5.1 *To initiate a turn, you use coordinated aileron and rudder to establish the desired bank angle.*

4.5.2 *To maintain a turn you apply sufficient back pressure on the stick to keep the pitch angle constant, and maintain the desired bank angle with coordinated use of the ailerons and rudder.*

4.5.3 *Adverse yaw is not present during the turn.*

4.5.4 *You stop a turn by using coordinated aileron and rudder to level the wings, and releasing the back pressure to keep the nose from rising.*

4.5.5 *When rolling to the left while holding the rudder neutral, the glider will yaw to the right.*

4.5.6 *If you are using the correct amount of rudder when rolling into or out of a turn the nose will not swing with respect to the horizon, but will rotate about a point.*

4.6 Precision Turns

4.6.1 *[C]*

4.7 Airbrakes in Flight

4.7.1 *If you maintain a constant pitch attitude when deploying the airbrakes the airspeed will decrease.*

4.7.2 *[A]*

4.8 Steep Turns

4.8.1 *The load factor will increase by about 35% when the bank angle is increased from 45° to 55°.*

4.8.2 *The load factor will increase by about 100% when the bank angle is increased from 60° to 70°.*

4.8.3 *[A]*

4.8.4 *When the glider is banked at 45°, a line connecting a pair of diagonal instrument mounting screws will be parallel with the horizon.*

4.8.5 *A 60° bank angle will put a load factor of 2 on the glider. Since the stall speed increases with the square root of the load factor, you would need an airspeed of at least 57 knots to keep from stalling in a 60° turn.*

4.9 Circling Flight

4.9.1 *[B]*

4.9.2 *[C]*

4.9.3 *[A]*

4.10 Crabbing During Cruising Flight

4.10.1 *[A]*

4.10.2 *[B]*

4.11 Stall Recognition and Recovery in Level Flight

4.11.1 *[C]*

4.11.2 *[A]*

4.11.3 *Stick back, nose rising, airspeed decreasing, wind noise decreasing, mushy controls, buffeting*

4.11.4 *To recover from a stall you must lower the angle of attack.*

4.12 Stall Recognition and Recovery in a Turn

4.12.1 *[C]*

4.12.2 *Stick back, nose rising, airspeed decreasing, wind noise decreasing, mushy controls, buffeting*

4.12.3 *Attempting to raise a wing with the ailerons while the glider is stalled will result in an increase in the angle of attack of the lowered wing, deepening the stall and possibly initiating a spin.*

4.13 Slow Flight

4.13.1 *You should lower the nose if you feel buffeting while flying at MCA.*

4.13.2 *More rudder is needed to coordinate the glider at MCA because induced drag, and therefore adverse yaw, are greater at low speeds. Also, the lower airspeed makes the rudder less effective.*

4.13.3 *The glider will stall if you increase your bank angle when flying at MCA without increasing your airspeed.*

4.14 Stall Recognition and Recovery with Airbrakes

4.14.1 *Stick back, nose rising, airspeed decreasing, wind noise decreasing, mushy controls, buffeting*

4.14.2 *The buffeting associated with a stall may be masked by turbulence from the open airbrakes.*

4.14.3 *[B]*

flying speed the glider can enter a secondary stall.

4.15 Side Slip – Correcting for Alignment Errors

4.15.1 *The ailerons are used to initiate a side slip when adjusting for alignment errors.*

4.15.2 *Your heading should not change when entering a side slip to adjust for alignment with the runway.*

4.15.3 *Using the ailerons, briefly bank opposite the direction of the slip, then return the wings to level with coordinated aileron and rudder.*

4.16 Side Slip – Compensating for a Crosswind

4.16.1 *The ailerons and the rudder are used simultaneously (but not coordinated) when transitioning between a crab and a side slip to compensate for a crosswind.*

4.16.2 *Your heading should be parallel with the runway after transitioning from a crab to a side slip on final.*

4.16.3 *Your descent angle will increase when using a side slip because of the increase in drag.*

4.17 Forward Slip

4.17.1 *[C]*

4.17.2 *[A]*

4.18 Low-G Maneuvers

4.18.1 *[C]*

4.19 Selecting a Cruise Airspeed

4.19.1 *[C]*

4.19.2 *[C]*

4.19.3 *[B]*

4.20 Deep Stall Recognition and Recovery

4.20.1 [A]

4.20.2 The glider will stall again.

4.21 Chandelle

4.21.1 [B]

4.21.2 [B]

4.22 Incipient Spin Recognition and Recovery

4.22.1 During a skidding turn, the glider's inside wing will try to drop since the dihedral angle causes it to be at a lower angle of attack. If the pilot then lowers the inside aileron to try to keep the wing from dropping, the angle of attack on that section of the wing will increase, leading to a possible stall and spin.

4.22.2 Stick back, nose rising, airspeed decreasing, wind noise decreasing, mushy controls, buffeting

4.22.3 The best way to avoid a spin related accident is to always enter the pattern with enough altitude.

4.22.4 Using the ailerons to try to level the wings during a spin can cause the spin to deepen because the inside wing will become more deeply stalled.

4.23 Spin Recognition and Recovery

4.23.1 [B]

4.23.2 [C]

4.23.3 (Glider specific)

4.24 Rapid Speed Changes

4.24.1 [B]

4.25 High-Speed Flight

4.25.1 [A]

4.25.2 [A]

CHAPTER 5

5.1 Landing Checklist

5.1.1 Radio, Undercarriage, Flaps, Speed, Trim, Airbrakes, Look, Land

5.1.2 You should you fly at the best L/D speed plus 1/2 the wind speed plus 1/2 the gust speed in the pattern.

5.1.3 If the glider you are training in does not have a retractable wheel, you should say, "undercarriage fixed" when reaching the Undercarriage part of the checklist.

5.1.4 During the "look" part of the checklist, you should look for other traffic, the wind conditions on the ground, and obstacles on the runway.

5.2 Introduction to the Landing Pattern

5.2.1 A standardized landing pattern allows you merge smoothly with existing traffic and allows you to familiarize yourself with the airport/field and conditions.

5.2.2 *You will make four turns in the pattern if you perform an upwind entry.*

5.2.3 *A crosswind entry gives you a better view of the airport, and more time to merge with traffic and to familiarize yourself with the conditions.*

5.2.4 *[C]*

5.2.5 *You should select your stop, touchdown, and aim points while on downwind.*

5.2.6 *[B]*

5.2.7 *The pattern is automatically adjusted for variations in entry height when you use "angles" to fly the pattern.*

5.3 Glide Slope Control Using the Airbrakes

5.3.1 *[B]*

5.3.2 *[B]*

5.3.3 *Sudden adjustments to the airbrakes when close to the ground can cause the glider to slam into the ground, or balloon into the air.*

5.3.4 *On most gliders, when the airbrakes are fully deployed, the wheel brake will be on.*

5.3.5 *[C]*

5.4 Radio Use

5.4.1 *(Airport specific)*

5.5 Crosswind Patterns

5.5.1 *When there is a crosswind, flying the base leg into the wind allows you a better view of the runway while on downwind, makes the turn from base to final less than 90°, and makes it less likely for the pilot to fly too slowly on base.*

5.5.2 *[A]*

5.5.3 *[A]*

5.6 Unusual Patterns

5.6.1 *[C]*

5.6.2 *When performing an "unusual" pattern you should fly the same airspeed that you would in a normal pattern.*

5.7 Forward Slip with Airbrakes

5.7.1 *[B]*

5.7.2 *[C]*

5.8 Turning Slips

5.8.1 *[A]*

5.9 Side Slip in the Pattern

5.9.1 *[C]*

5.9.2 *[A]*

5.10 No Altimeter Pattern

5.10.1 *[B]*

5.11 No Altimeter/Airspeed Pattern

5.11.1 *A clogged static port could cause both your altimeter and airspeed indicator to malfunction.*

5.11.2 *[A]*

5.12 No Airbrake Pattern

5.12.1 *[C]*

5.13 Full Airbrake Pattern

5.13.1 *[B]*

5.13.2 *[C]*

CHAPTER 6

6.1 Introduction to the Landing

6.1.1 *Airbrakes half-open, airspeed constant, aligned with the runway centerline, eyes on the aim point*

6.1.2 *Transition from descending to level flight, eyes transition to the horizon, airspeed decreases (but does not need to be monitored)*

6.1.3 *Eyes on the horizon, main wheel 1-2 feet off the ground, wait for airspeed to bleed off*

6.1.4 *Steer with rudder, keep wings level with ailerons, balance on main wheel as long as possible*

6.1.5 *[A]*

6.1.6 *[B]*

6.2 Precision Landings

6.2.1 *[B]*

6.2.2 *[C]*

6.3 Crosswind Landings

6.3.1 *[A]*

6.3.2 *[C]*

6.3.3 *[C]*

6.3.4 *[B]*

6.4 Landing Over an Obstacle

6.4.1 *[A]*

6.4.2 *[B]*

6.5 Simulated Off-Field Landing

6.5.1 *[C]*

6.5.2 *[A]*

6.6 Downwind Landings

6.6.1 *[C]*

6.6.2 *[B]*

6.6.3 *[A]*

6.7 High Wind Landings

6.7.1 *[A]*

6.7.2 *The lower ground speed during a high wind landing can lead a pilot to touch down at too high of an airspeed, leading to a PIO.*

6.7.3 *[C]*

6.8 High Density Altitude Landings

6.8.1 *[B]*

6.8.2 *[B]*

6.8.3 *During a downwind landing at high altitude the glider will have a much higher ground speed, which will cause more damage if it hits any obstacles on the ground.*

CHAPTER 7

7.1 Thermaling

7.1.1 *[B]*

7.1.2 *[B]*

7.1.3 *[C]*

7.1.4 *[B]*

7.1.5 *[C]*

7.2 Mountain Wave

7.2.1 *[C]*

7.2.2 *[A]*

7.2.3 *[B]*

7.3 Ridge Lift

7.3.1 *[A]*

7.3.2 *[B]*

7.3.3 *[B]*

7.3.4 *[B]*

7.3.5 *[A]*

7.4 Convergence/Shear

7.4.1 *[B]*

7.4.2 *[B]*

CHAPTER 8

8.1 Introduction to Premature Aerotow Release

8.1.1 *[A]*

8.1.2 *[B]*

8.1.3 *[C]*

8.1.4 *Having a prearranged rope-break plan saves time in an emergency by allowing you to simply execute the plan, instead of first having to decide on a course of action.*

8.2 Simulated Rope Breaks

8.2.1 [B]
8.2.2 [A]

8.3 Rock Off

8.3.1 [B]

8.4 Tow Plane Power Loss During Takeoff

8.4.1 [C]
8.4.2 You will turn to the right.

8.5 Tow Plane Power Loss at Altitude

8.5.1 [C]
8.5.2 [B]

8.6 Simultaneous Release Failure

8.6.1 [B]
8.6.2 [A]
8.6.3 [C]

8.7 Spiral Dive Recovery

8.7.1 During a spiral dive, there will be significant wind noise and you will be pulling high Gs. In a spin, the noise will be much quieter due to the low airspeed, and the G forces will be near 1.
8.7.2 [C]
8.7.3 [C]

8.8 Unusual Attitude Recovery

8.8.1 Lower the nose of the glider.
8.8.2 Level the wings of the glider.
8.8.3 [B]

8.9 Intercept Procedures

8.9.1 [A]
8.9.2 You should set your transponder to 7700 and contact ATC on 121.5 if you are intercepted.
8.9.3 [B]
8.9.4 [B]

CHAPTER 9

9.1 Situational Awareness

9.1.1 [C]

9.2 Judgment

9.2.1-7 (Student specific)

9.3 Self-Discipline

9.3.1 [C]
9.3.2 [A]